The OIL AND GAS JOURNAL

MARCH 26, 1956

Is Permian Basin Near Its Peak?

Some say yes, but the majority disagrees. p. 66

Water Flooding in 1980

. . . Seen as 25 per cent of U. S. production. p. 72

FPC Splits Over New Policy

p. 76

Four Ways to Reduce Drilling Time

p. 98

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LET YOUR WELL SAY WHICH

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

"PROGRESS IN SERVICE THROUGH RESEARCH"

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A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Government research on oil shale, dropped last year by the Interior Department, is far from dead.

Navy officials see in shale an important source of diesel fuel and distillate for jet fuel. They fear that in the event of another war both products, but more importantly diesel fuel, would be hard to come by in sufficient quantities. They are not interested in the possible gasoline output, however.

A big-inch internal pipeline caliper is being used by United Gas Pipe Line Co. to spot corrosion damage. The device can give exact location of weak points. So far it's been run on a wire line in 1 to 2-mile stretches. It can be made "free wheeling" for longer runs, carrying equipment to record wall thickness and distance from starting point.

When the FPC and the Texas Railroad Commission lock horns, who wins? A District of Columbia federal court may decide soon.

Operators in La Gloria field will file suit against FPC. They have been ordered by FPC to sell gas to Texas Illinois Gas Pipeline Co. The Railroad Commission has ordered them to cycle the same gas in order to increase ultimate recovery. It's a major conflict between a government agency and a state regulatory commission, and the case will be followed closely.

A new federal invasion of state activities is in the making. The Labor Department is sending out the draft of a model workmen's compensation bill which it will urge the states to adopt. Industry and business leaders, union officials, and others have been asked for comment. The bill would provide uniform standards throughout the nation, most of them far beyond anything the states now have in force. Added cost to employers could run into millions of dollars a year.

More and more magnetic-tape recorders are being put to work by seismic crews.

It is now estimated that more than 20 per cent of the crews in the field are using them. However, high cost of both the recorders and the playback systems has made many geophysical contractors hesitant.

Also unsettling are the lack of standardization in equipment and the uncertainty over the future of the method.

An outlet for several natural-gasoline plants in the Agua Dulce area of South Texas may be provided by Tennessee Gas Transmission's new line to Houston. The line is being built to serve T.G.T.'s Banquete plant.

The company, however, has contracted for some mixed products and is trying to buy more. The line will provide raw material for Petro-Tex Chemical's big butadiene plant near Houston in which T.G.T. has a half interest.

The Roosevelt-Morse bills to regulate relations between suppliers and service-station operators may get to the House floor before adjournment.

The House judiciary committee will hold a hearing on the Roosevelt bill next month. It is designed to eliminate gasoline price wars and dealer complaints against major-company controls on their operations.

The OIL AND GAS JOURNAL

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TECHNOLOGY–OPERATION

Pipelining

Electronic Computer for Pipeline Design Calculations **136**
By H. E. Thomas
Electronic computers lend themselves to pipeline design by eliminating many tedious and repetitious manual calculations. Once the programing is set up performance of an entire line can be calculated in minutes.

Pipeline Patrol: Fundamentals of Corrosion Control **159**
Here are the answers to questions posed by foremen, technicians, and engineers at the recent corrosion short course sponsored by the Tulsa section of N.A.C.E.

Refining—Processing

Phillips Chemical's Houston Ammonia Plant **106**
By John C. Reidel
Phillips Chemical Co. operates a 450-ton per day ammonia plant (design capacity) in the Houston ship channel. The plant has an improved high-temperature radiant heater used in steam-methane reforming.

Piping Bridge Replaces Underground System **117**
By E. G. Fitzgerald
Esso Standard's Baltimore refinery has replaced its original piping system with an all-welded structural steel, three-span, 500-ft. piping bridge system. It links the major crude and finished products storage area with the refinery's main processing area.

Boron Compound Lifts Motor-Fuel Octane **121**
By E. C. Hughes, P. S. Fay, and W. T. Wotring
A boron compound used as a gasoline component effectively reduces surface ignition in gasoline engines without accumulating in the engine. It increases F-1 antiknock effect of tetraethyl lead in most gasolines and counteracts in part the bad effects of sulfur compounds on TEL.

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Automation of Lease Facilities **94**
By L. M. Hubby
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Four Ways to Reduce Drilling Time **98**
By L. S. Lowe
Increased hole-deflection tolerances, oversize drill collars, and jet bits have reduced drilling time substantially in Big Mineral field, Grayson County, Texas. Drilling time on a typical 7,000-ft. well was cut 41 per cent.

Centrifugal Mist Extraction in Field Processing **101**
By Dr. John M. Campbell
Centrifugal force is an integral part of oil and gas separation processes. This principle is used in some mist-extractor elements.

Skidding a Big Rig—Quickly, Safely, Economically **103**
Here in picture sequence the Journal dissects the technique of skidding a big rig from one location to another. Fast rig moving is essential in this period of high drilling costs.

Air Drilling at Shallow Depths **135**
By Ralph Hague, Jr.
W. R. Tuley Drilling Co. has completed three wells in Muhlenberg County, Kentucky—two with air and one with air and water. Air drilling is successful in this area where there is a general absence of water-bearing formations.

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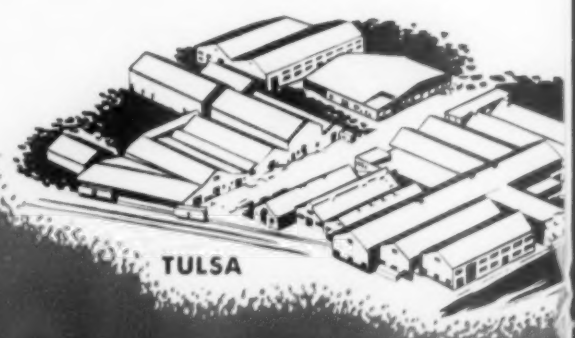

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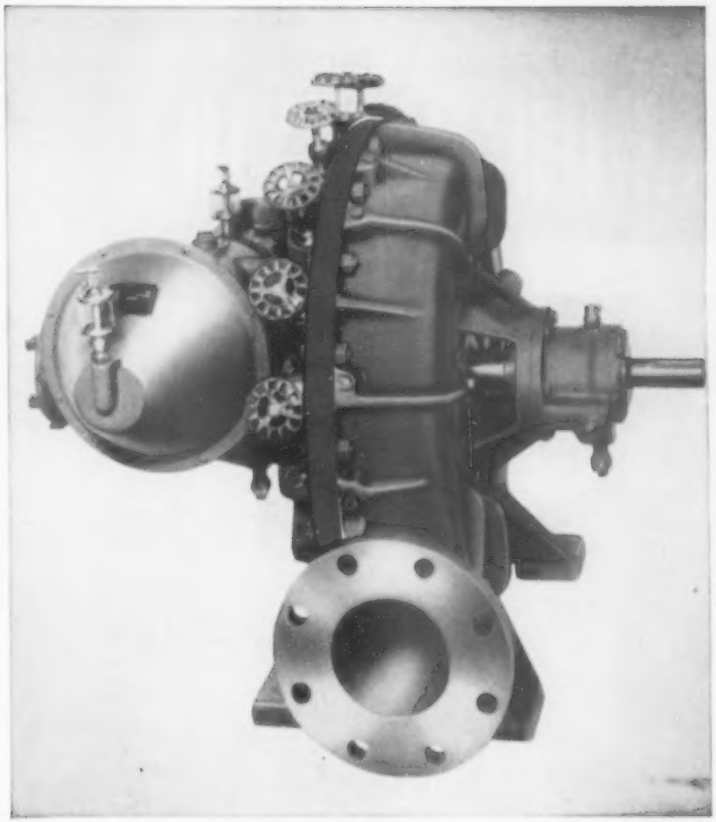

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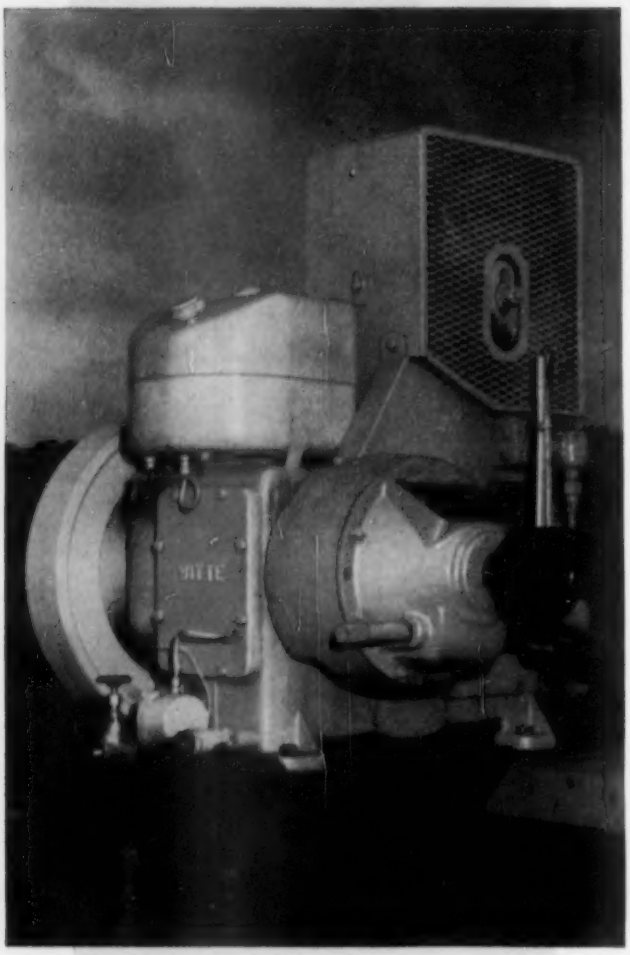

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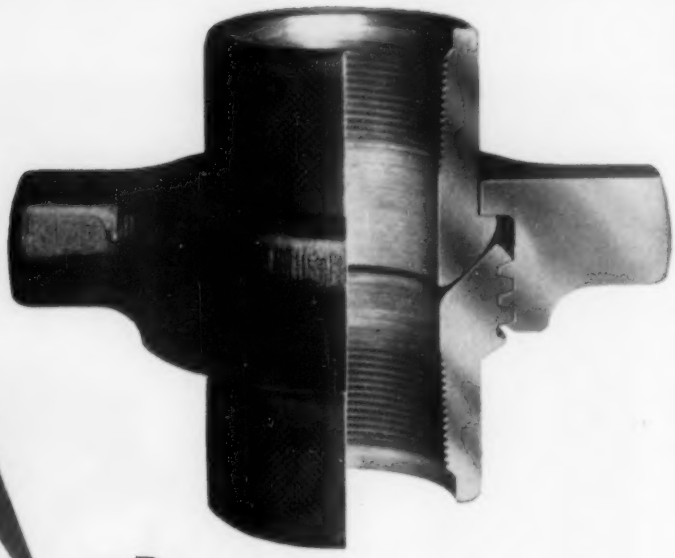

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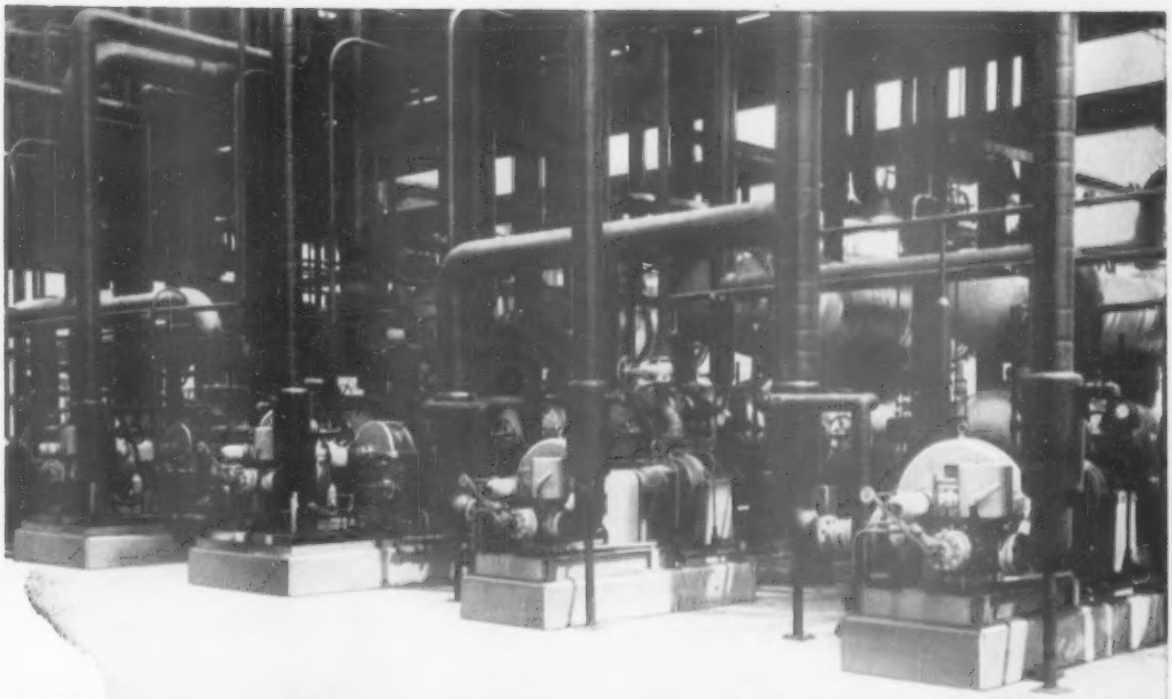
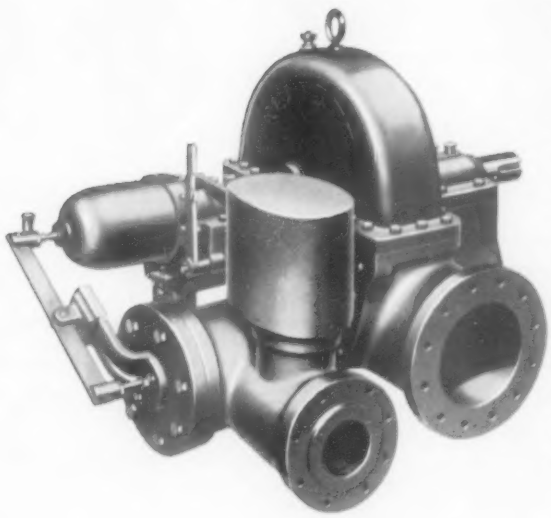


Elliott—the turbine you'll see all over

. . . the Richfield Oil Corporation's new Los Angeles, Calif. refinery



● The Elliott YR turbines in the photo above are just a few of many all over this up-to-the-minute "cat-cracker." Scores of them, ranging in sizes from 2 hp to 600 hp, are on the job driving process and water pumps, fans and compressors.

Elliott YR mechanical drive turbines are perfectly at home in refinery service. Their reputation for dependability has been earned by thousands of successful installations. Although maintenance requirements are simple, users like the ease of inspection, accessibility of wearing parts, and the interchangeable components. Bulletin H-22 gives complete details. Write Elliott Company, Steam Turbine Department, Jeannette, Pa.

ELLIOTT Company

H4-6

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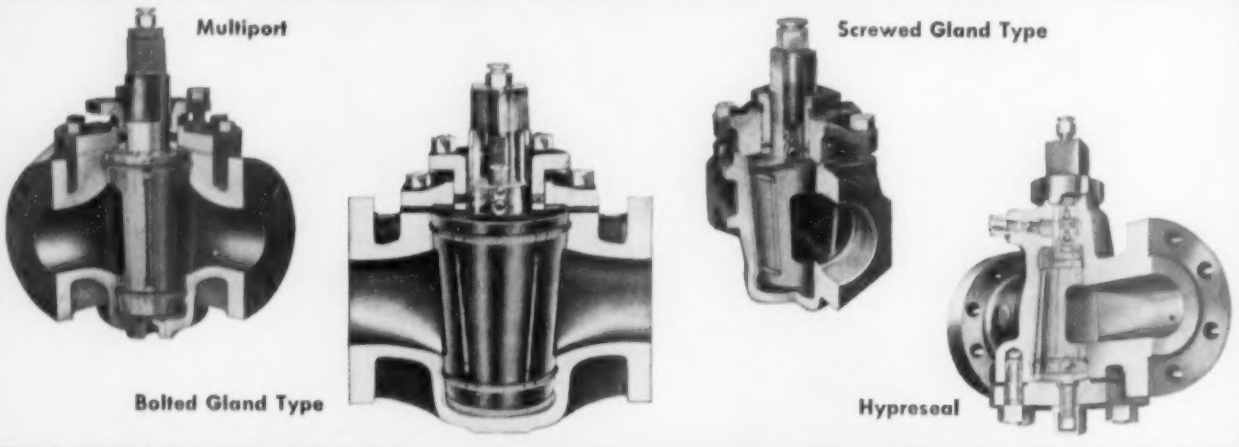

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3.

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4.

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5.

Full Floating Hypreseal Plug. The Hypreseal stem is entirely independent of the tapered valve plug except by a floating equalizer ring. The stem has a long threaded engagement in the neck of the valve body to carry the outward line pressure thrust and seals against leakage without excessive friction of deep stuffing boxes. The stem thread is lubricated and sealed by lubricant from the chamber surrounding the equalizer. Injection type packing prevents escape of lubricant around the stem.

6.

Resilient Plug Seating. In Rockwell-Nordstrom valves the plug has a small, but highly important, degree of resiliency. This prevents binding, allows the lubricant "jacking" action to function properly, and avoids unseating which would result in loss of lubricant, seat exposure or damage.

7.

Shoulder Seal. The shoulder type of stem seal is used in preference to conventional stuffing boxes. It is compact, produces a minimum of friction, and combines the functions of stem seal and thrust bearing.

8.

Smoothly Contoured Passages. The interior of Rockwell-Nordstrom valves presents an unbroken line devoid of crevices for any lodgment of line contents. Flow characteristics are designed for minimum pressure drop.

9.

Repackable under Pressure. The Rockwell-Nordstrom Hypreseal is the only valve that can be repacked under any line pressure and in any position. This eliminates shutdown of the line. No packing gland or stuffing box is used.

10.

Adjust or Lubricate under Pressure. Rockwell-Nordstrom valves are the only type of valve that can be fully adjusted and lubricated in service. In any operating position the plug can be jacked from its seat by a few turns of the lube screw or by injections with a lubricant gun.

11.

Flow Either Way at Any Differential. Rockwell-Nordstrom valves are not restricted to one-way flow. There is no single "pressure side" requiring a specified end to go on the upstream side. Since the Rockwell-Nordstrom non-wedge action and transfer of plug pressure to the lubricated seat allows *operation at any pressure differential* within its range, galled or frozen valves and by-passes are eliminated.

12.

No Bonnet Cavity—Saves Weight and Space. Compare the overall dimensions of Rockwell-Nordstrom valves with any other type of valve and note the saving in space. For most Rockwell-Nordstrom valves the space occupied is little more than the diameter of the line pipe flanges.

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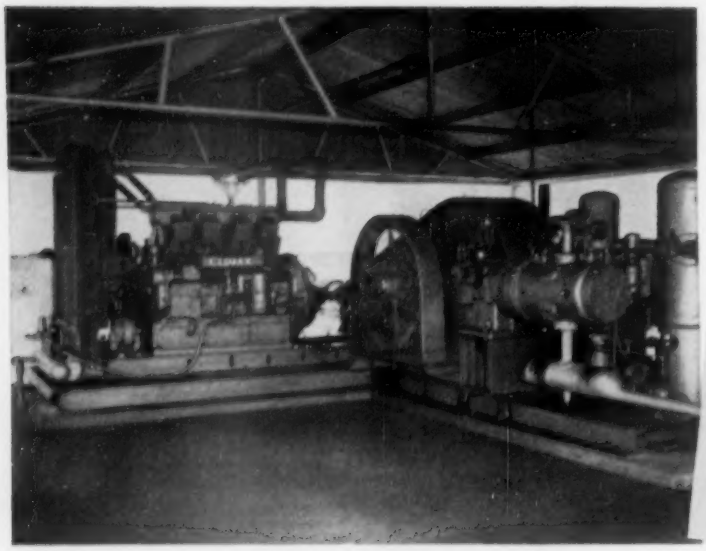

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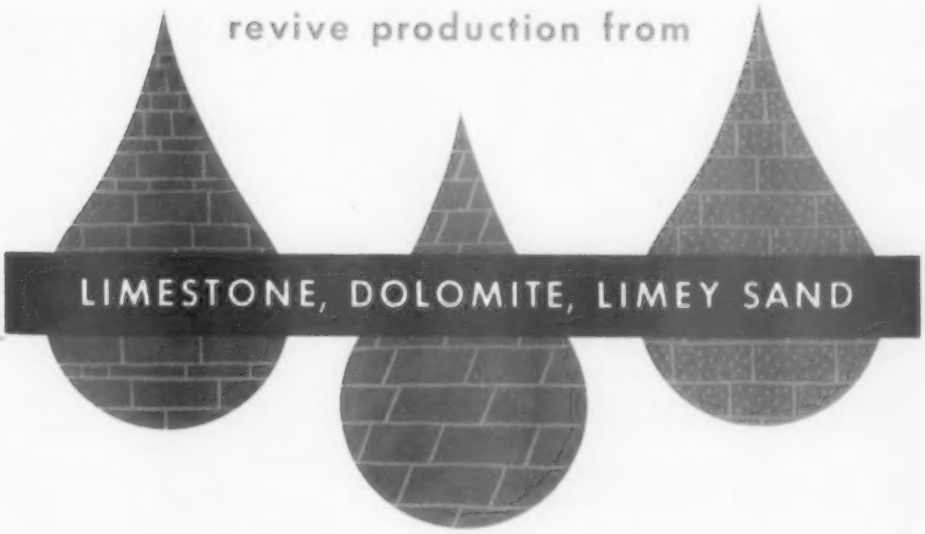


with

HALLIBURTON'S *Acidfrac*

In old wells producing from lime-containing formations, Halliburton's Acidfrac is most often successful in reviving dwindled production and putting hundreds or thousands of barrels of oil in the tanks that would otherwise stay in the formation.

THE REASON: Since Acidfrac is a thickened, emulsified acid mixture, it does not all react immediately with the formation lime. Instead, it continues to react while being pumped farther from the well bore . . . acidizing as it fractures new volumes of the formation. Acidfrac is still 50% active after 30 minutes under pressure.

A suggested procedure is then to follow Acidfrac with a conventional thin acid which is partly deflected into finer channels since the Acidfrac emulsion still blocks the fracture. In a few hours, the Acidfrac has thinned through reaction and the formation is ready for renewed production.

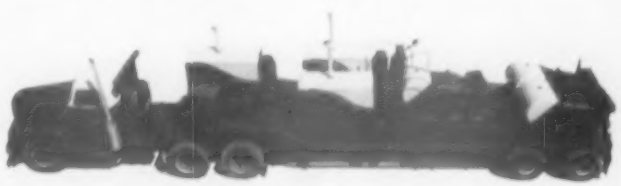
THE RESULT: Four to nine times the drainage volume is opened up compared with ordinary acid treatment. This reasoning is backed by the evidence that Acidfrac has produced more oil from 90% of old wells treated and usually more oil or gas from each retreatment.

Even in pure sandstones, one type of Acidfrac can increase production by opening up new flow channels, as shown by many successful treatments.

For complete information on Acidfrac and other profitable fracturing techniques, call your local or district office of the Halliburton Oil Well Cementing Company.

COMPLETE DATA SENT ON REQUEST

Get this valuable information for your Halliburton Service File

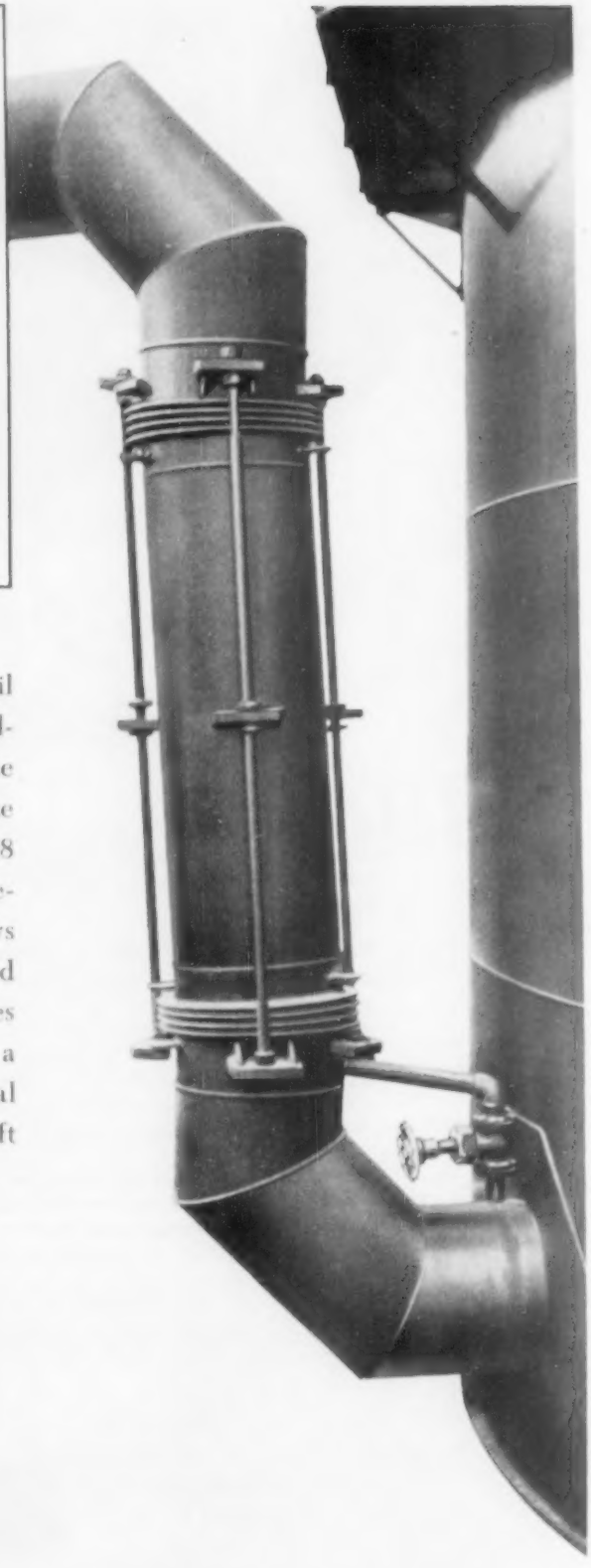


HALLIBURTON FRACTURING SERVICES

250 SERVICE CENTERS – JUST MINUTES AWAY FROM ANY RIG

SOLA FLEX®

expansion joints for Standard of California



AT THE EL SEGUNDO REFINERY of Standard Oil Company of California, this Sola-Flex bellows assembly does a big job. It absorbs the movement of a 228 foot overhead line. The double-end tied-joint takes a total of 10.88 inches of thermal growth by offset movement. And the end thrust of the bellows caused by internal pressure is not imposed on the piping system. All major oil companies use Sola-Flex expansion joints. Send for a catalog describing standard and special designs. Write Dept. B-133, Solar Aircraft Company, San Diego 12, Calif.

SOLAR

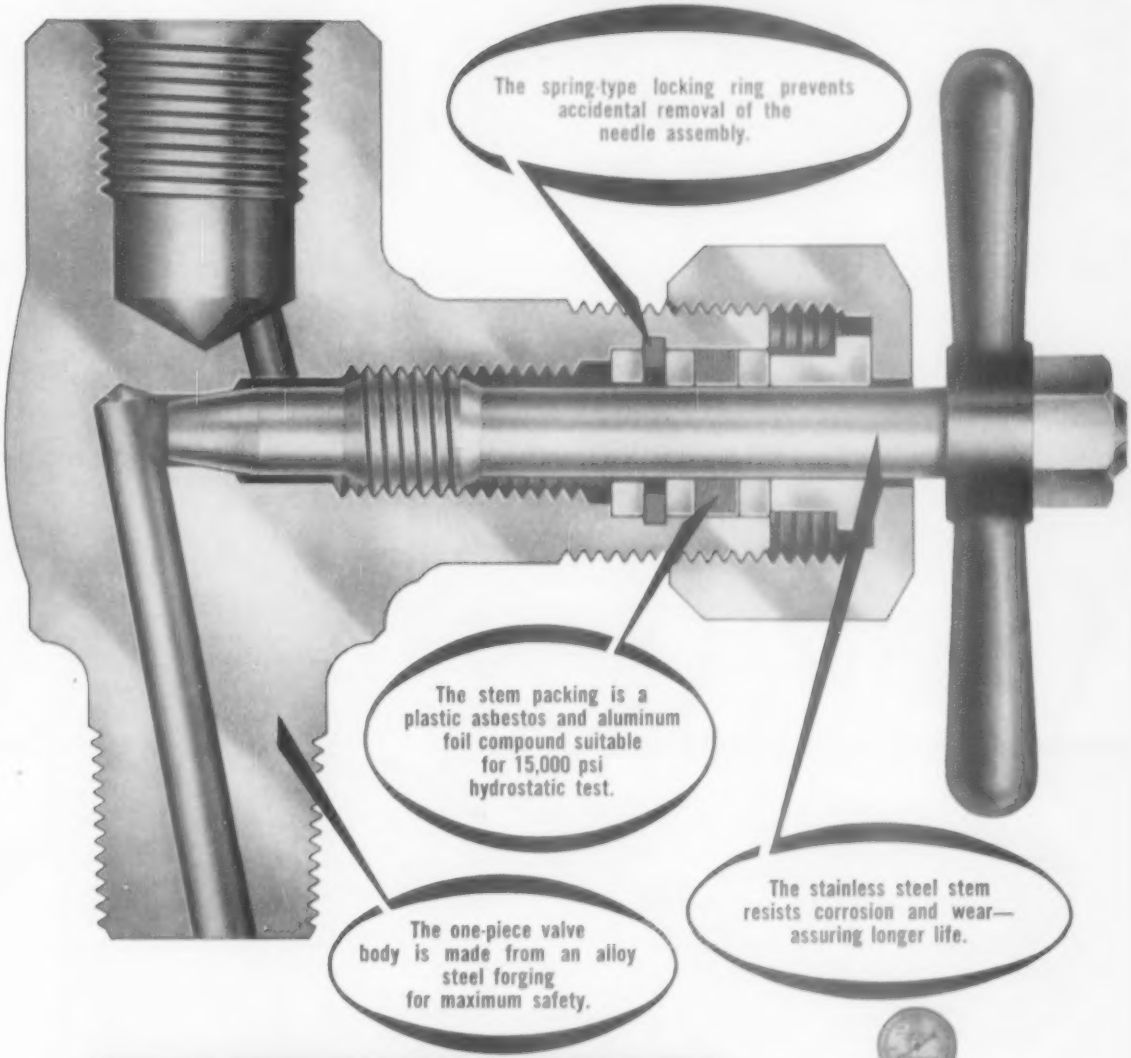
AIRCRAFT COMPANY

SAN DIEGO DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF GAS TURBINES • AIRCRAFT AND MISSILE COMPONENTS • BELLOWS • CONTROLS • HIGH TEMPERATURE COATINGS • METAL ALLOY PRODUCTS

...the safest pressure-gauge needle valve

is made by... O·C·T

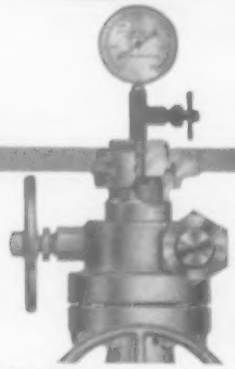

The spring-type locking ring prevents accidental removal of the needle assembly.
The stem packing is a plastic asbestos and aluminum foil compound suitable for 15,000 psi hydrostatic test.
The stainless steel stem resists corrosion and wear—assuring longer life.
The one-piece valve body is made from an alloy steel forging for maximum safety.

O·C·T

OIL CENTER TOOL CO.

P. O. Box 3091, Houston, Texas

Export Representatives: Sterling Areas — La Grand, Sutcliff & Bell, Ltd., Rochester, Kent, England. South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.



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KAMLOKS positive seal all along the line assures *greater safety* in handling any type of liquid. A perfectly tight no leak connection is made in seconds by sliding coupler over adaptor, then pressing cam levers. No threads to engage, no twisting friction against gaskets, no tools required. KAMLOKS provide long years of economical trouble free service.

Available in any combination to meet coupling requirements in sizes from ¾" to 4" inclusive. Sizes ¾" through 4" of special hard wear-resistant bronze and OPALUMIN (hi-tensile aluminum alloy requiring no additional heat treating). 1" through 4" of monel. 1" and 2" (633A and 633B only) of stainless steel.

Parts A, E, F, are interchangeable with parts B, C, D, G, H, in the same size.

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FREE BULLETIN F-10 tells the complete KAMLOK story

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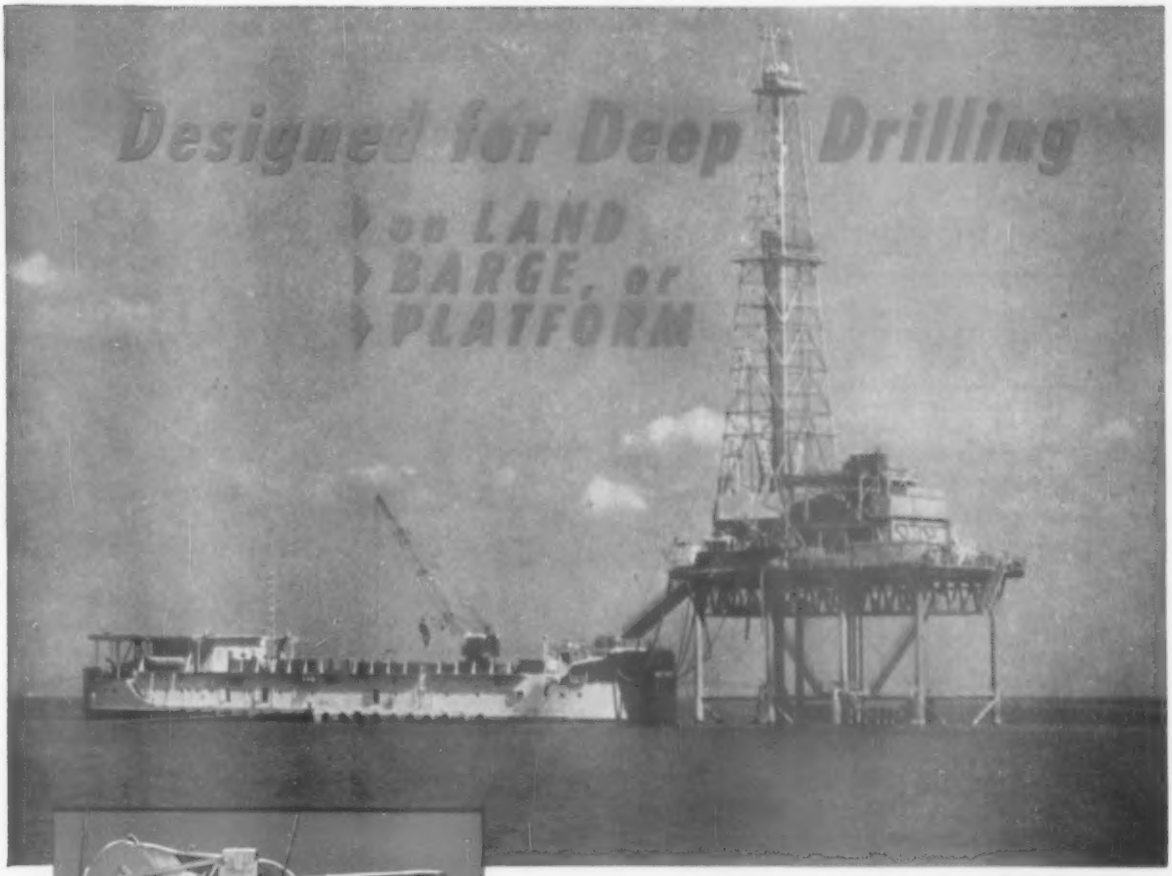

- Adjusting linkage and exposed hardware protected against corrosion by special plating.
- Sectional construction facilitates transportation.
- Six hoisting and three rotary speeds.
- Two 42-inch VC 1200 Fawick Ventorque clutches on drum shaft.
- Parkersburg hydromatic brake or Dynamatic brake on extended drum shaft.
- 32¼" x 57" drum, with 60" x 10" water circulating brake rims.
- Coring reel package, friction clutch controlled, optional.
- As an electric rig—drawworks can be furnished with friction or jaw clutches.

Unit Rig U-1220* Drawworks

The Model U-1220 was developed specifically for deep drilling. It meets all requirements for extreme depths, portability and endurance—regardless of location.

The rig shown above drilling in the open Gulf is equipped with a Unit Rig Model U-1220 drawworks, and a 3-engine rig drive. The drilling barge tender carries 3 Emsco D-700 slush pumps, powered through an LS1420 Unit Rig 3-engine, 3-pump drive compound by 3 PTDS-8 Superior diesel engines.

All major drilling equipment was furnished by Mid-Continent Supply Company.

* Indicates 1200-2000 input horsepower.

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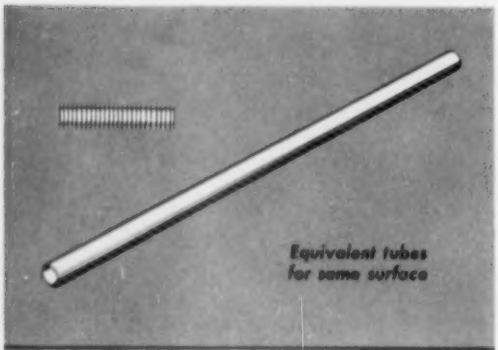
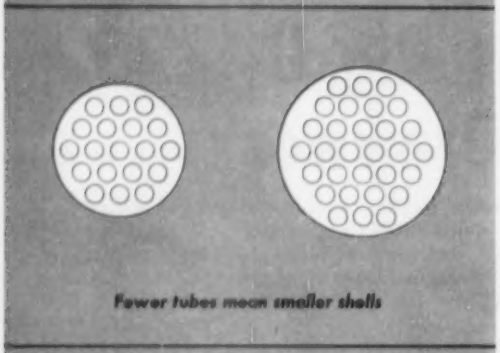
. . . IN THE LIGHT HYDROCARBON CONDENSING FIELD

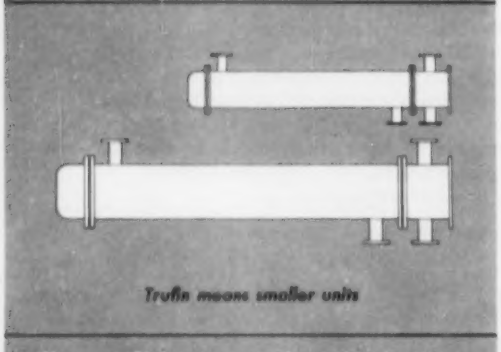
Third in a series of advertisements designed to show new opportunities in heat exchange.



Equivalent tubes for same surface



Fewer tubes mean smaller shells



Trufin means smaller units

You can find out more about the down-to-earth cost-saving advantages of Trufin if you write for the booklet "An Opportunity". It's your proof positive!

Wolverine Trufin* Type S/T condenser tube gives you two distinct opportunities to save money in condensing light hydrocarbons.

1. If you are building a new unit, Trufin can slash your total tube requirements. Fewer tubes mean that you can design smaller shells, headers, baffles—cut down on structural support. Too, you reduce tube-cleaning time—down-time costs money!

2. And if you are revamping an existing unit, the substitution of Trufin for prime surface tube can step up capacity—give you more heat duty per condenser. Trufin is mechanically interchangeable with plain tube.

The secret is simple. Trufin Type S/T is the extended surface tube designed particularly for shell and tube condensers. Its fins are integral with the tube wall. Because Trufin is all one piece, its fins won't separate because of vibration or thermal shock. That means constant fin efficiency in tough jobs.

Yes, Trufin gives you real opportunities to save!

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario.

*REGISTERED U. S. PATENT OFFICE

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

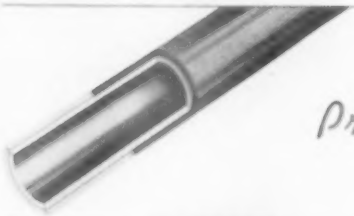
MANUFACTURERS OF QUALITY CONTROLLED TUBING AND EXTRUDED ALUMINUM SHAPES

5 More Condenser Tube Products

So that you will have complete flexibility in selecting the condenser tube that's exactly right for your needs, Wolverine produces five more types of condenser tubes in addition to Trufin Type S/T. Each is a product of research—of engineering skill—of Tubemanship. Each of them, too, has a record of outstanding performance in installations throughout the country.

Prime Surface Tube

—You can select the prime surface tube of the right metal for your job. Wolverine produces prime surface tube in copper, copper-base alloys and aluminum.

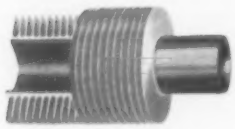


Duplex Prime Surface Tube

—If you have varying corrosive conditions, it might be to your advantage to investigate the use of Wolverine's Duplex condenser tube. Many alloy combinations are available to exactly meet the difficult corrosion situations you encounter.

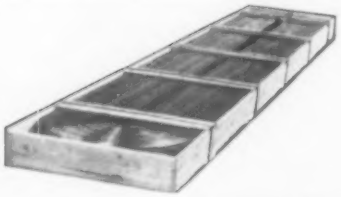
Duplex Type S/T Tube

—designed again for specific corrosive conditions. Duplex S/T is finned—just like Trufin—so that it will boost transfer efficiency. It can be substituted directly for prime surface tube.



Trufin Type L/C

—bi-metal with an exterior of light weight, high-finned aluminum with a liner of copper, copper-base alloy, or steel. Trufin L/C withstands corrosion—provides high heat transfer efficiency over a long period of time.



U-Bend Pallets

—offer time- and money-saving possibilities for condenser applications. U-bend condenser tubes—either plain or finned—are arranged in a disposable box-type pallet in the exact order of their installation. Complete units can be carried in inventory—saving floor space, time and trouble.

Wolverine also provides a complete Field Engineering Service to help processors with condenser problems. Information is available in Wolverine's 39-page Condenser Tube Catalog. Write for your copy today! WOLVERINE TUBE, 1449 Central Ave., Detroit 9, Mich.

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Moves and rigs up readily and economically on land or sea, as a good mast should. Drilling rig of any type or size can be used.

Ample room for an independent rotary drive. Wellhead equipment easily installed, and readily cleared when skidding.

Everything about this IDECO Full View Mast is designed to save time and money — the raising mechanism, racking platform, crown block, ladders, deadline anchor, substructure — even the rathole position.

It is made especially for the man who wants to be proud of his equipment, and expects the equipment to justify his confidence. You get *everything* in an IDECO Full View Mast.

Read the details and study the diagrams in Bulletin FVM-53. Address JONES & LAUGHLIN SUPPLY DIVISION, P. O. Drawer 2481, Tulsa, Oklahoma, or 'phone your J&L store.

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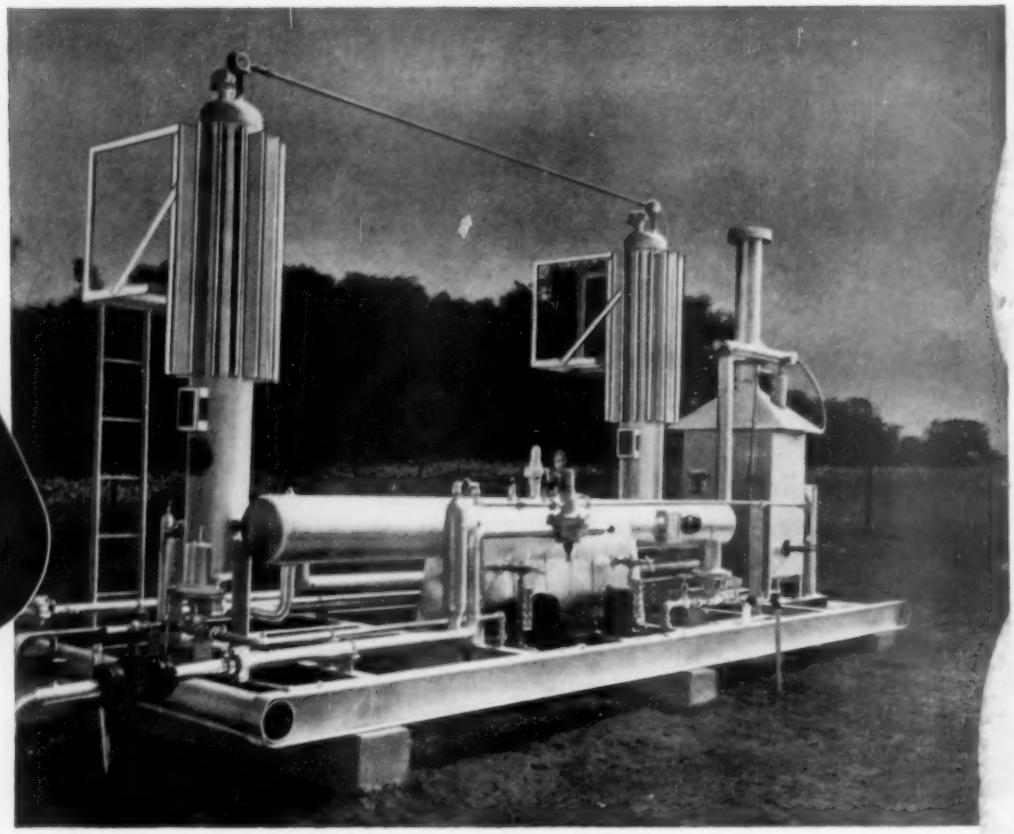
Hundreds of thousands of barrels of oil reserves are being produced today that might still be in the ground . . . except for scientifically-planned and executed drilling mud programs. These new oil reserves have come from deeper formations (which require carefully weighted and balanced drilling fluid columns), from water-sensitive sands (which require invert-emulsion muds), and countless other conditions where better mud programs have resulted in better producers.

Magcobar has met the responsibility of providing the oil industry with new and improved drilling fluid ingredients through a continuous chemical research program that has produced, for example, the industry's first 30 lb./gal. mud (G-7 Super-Weight), the industry's first free-flowing concentrate invert-emulsion mud (No-Blok), the industry's first bulk Can-A-Mud, plus an exploration program which has provided Magcobar adequate stocks and reserves of barite and bentonite to meet the demands for today and the future.

Look for the Magcobar Dealer sign when you need mud. You'll get the best service and the best products available, wherever you drill.

MAGNET COVE BARIUM CORPORATION
HOUSTON, TEXAS

the newest concept in gas dehydration



PARKERSBURG *DAU WELDRIER

The need for an advanced gas dehydration method has been so great that one of the nation's largest producers of natural gas worked hand in glove with Parkersburg for three years developing and testing this Dynamic Adsorption Unit.

*Dynamic Adsorption Unit

In the entire industry, there is nothing like the DAU WELDRIER. It is completely new in principle, in performance, in efficiency — and in economy.

The DAU is the only unit designed to take full advantage of the dynamics of the adsorption process.

It uses less than a third as much desiccant as conventional dehydrators of similar capacity and 80% less fuel gas.

It is completly unitized and requires only four field connections to put it on stream.

It is only about half the overall size of conventional units of similar capacity — costs far less to install.

Its first cost is less, its operating cost is far less, and it pays out faster.

The DAU Weldrier is the first unit of its kind to make it possible to take advantage of wellhead dehydration . . . nor is there any other unit that will dehydrate small quantities of gathered gas at line pressures as efficiently and economically.

You owe it to yourself to get the performance, efficiency, and economy the DAU WELDRIER brings to gas dehydration. Your Parkersburg representative has all the facts.

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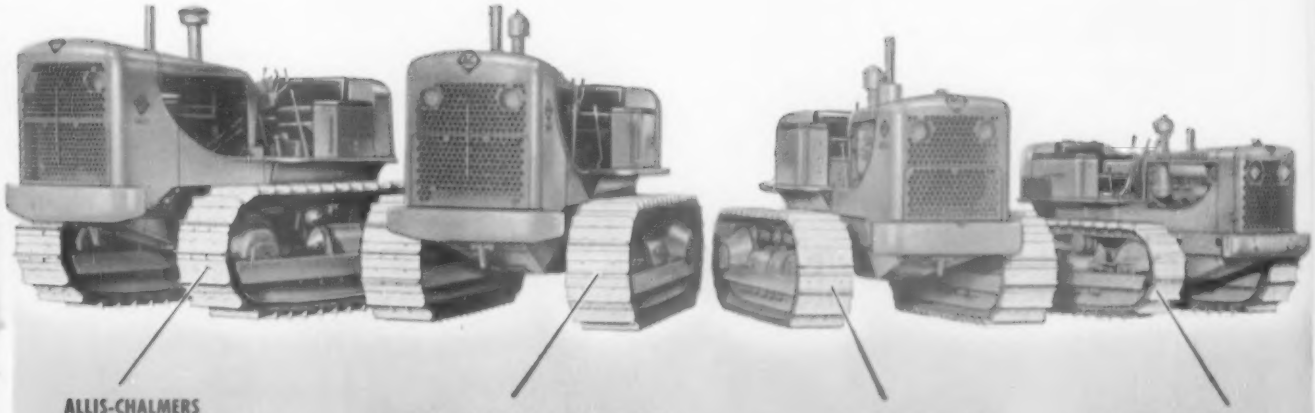

ALLIS-CHALMERS HD-21 TORQUE CONVERTER TRACTOR
Hp — 204 net engine
Weight — 44,000 lb
Drawbar pull — up to 65,000 lb

ALLIS-CHALMERS HD-16 TRACTOR
Standard Transmission
Hp — 141 belt
Weight — 31,500 lb
Drawbar pull — up to 37,700 lb

Torque Converter Drive
Hp — 150 net engine
Weight — 31,600 lb
Drawbar pull — up to 60,000 lb

ALLIS-CHALMERS HD-11 TRACTOR
Hp — 85 belt
Weight — 20,500 lb
Drawbar pull — up to 21,980 lb

ALLIS-CHALMERS HD-6 TRACTOR
Hp — 55 belt
Weight — 12,400 lb
Drawbar pull — up to 12,650 lb

HERE IT IS . . . the all-new Allis-Chalmers line of crawler tractors . . . with more of everything you've wanted most in oil field work — more work power, more long-life features, more easy maintenance and easy operation features, more versatility in every tractor.

You get all the benefits of Allis-Chalmers advanced basic design with the new Allis-Chalmers diesel engine . . . proved torque converter drive for the HD-21 and HD-16 . . . all-steel box-A main frame . . . unit construction . . . 1,000-hour lubrication intervals for truck wheels, idlers, support rollers . . . double-reduction final drives, and many other profit-producing features.

And there's a complete spread of tractor equipment — hydraulic and cable dozers, heavy-duty oil field winches, big-capacity side booms. You can choose from a full line of tractor shovels ranging from 1½-yd to 4-yd capacity.

Behind this equipment are dealers with sales and service personnel and facilities that assure you expert "after sales" care. The True Original Parts they stock help give you continued top performance and long equipment life.

Your Allis-Chalmers dealer will show you how these feature-packed crawlers can do your jobs better and at lower cost. See him for full details.

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THIS 400,000 Pounds per HOUR

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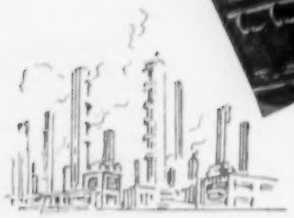
STEAM GENERATOR

Gives Top Performance in a Leading Texas Petroleum Refinery

VIEW OF THE COMPLETED STEAM GENERATOR



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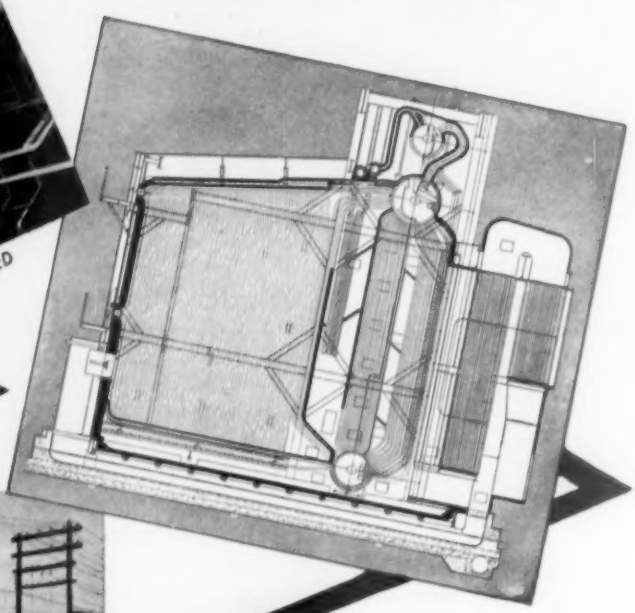
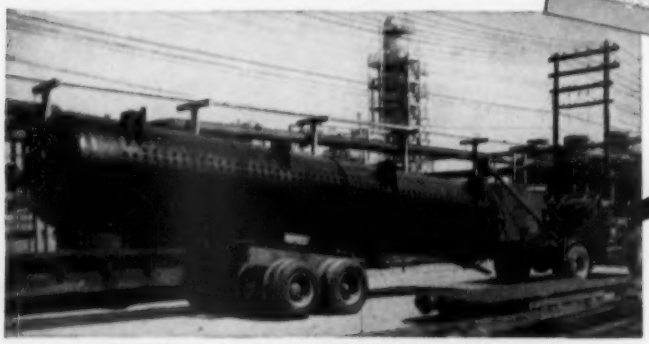
LONGITUDINAL SECTION THROUGH THE UNIT.





6'-6" DIAMETER x 37'-0" LONG STEAM DRUM BEING TRANSPORTED TO THE ERECTION SITE DURING INSTALLATION.

PRINCIPAL DATA

400,000 pounds per hour capacity.

Fusion welded steam and water drums designed for 700 lbs. S.W.P.

Superheater delivers steam at 750°F. total temperature.

Water cooled furnace.

Burners for Oil and Acid Sludge fuel.

Vogt builds a complete line of bent tube steam generators designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Write for bulletins.

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The colorful story of the Old West is told best through famous cattle brands such as the Running W, the Frying Pan, and the Spur. These and other similar brands distinguished the famous cattle herds in the history of the west.

Today the big red "W" is the brand seen at more and more well completions because it is the mark of quality performance in logging, perforating, fracturing and acidizing.

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LORAIN MOTO-CRANES are "Easy to move ON OILFIELD LOCATIONS"

Says

Patterson Mud & Chemical Co., Inc.

Houma, Louisiana

QUOTES GENERAL MANAGER ARTHUR E. LEE of Patterson Mud & Chemical Co., Houma, Louisiana, about their 15-ton Lorain rubber-tire crane . . . *"This unit is used mostly away from the plant, since it is easy to move over the highway and on oilfield locations. The Lorain has proved very satisfactory for our varied and unusual uses."* Scenes and statements like this are repeated whenever and wherever Lorain rubber-tire cranes go to work in the oilfields. Whether it be a supply yard, in the oilfields themselves, at a refinery or on pipelines, oil men have found that Lorain rubber-tire crane speedy mobility, plus on-the-job versatility, pays important dividends in lowered costs, more output.

THIS 2-TIME LORAIN OWNER

gets up to 24-hour per day duty from their Lorain on jobs such as handling oilfield pipe and equipment of all sizes and weights, or lifting 6000 lb. cans of bulk drilling mud to dump into large hoppers on scattered locations.

WHEN *travel speed and mobility* . . . in addition to easy operating, long-lived service . . . is a requirement for your lifting, loading, material handling or excavating jobs, see your Thew-Lorain Distributor. He offers the most complete assortment of rubber-tire shovel-cranes with speeds up to 45 m.p.h. and lifting capacities up to 45-tons on rubber. He will explain how Lorain features can result in more work, lower cost and longer life.

Lorain MC-254 Turntable Features Can Make You Money

TURNTABLE FEATURES — 5 identical, interchangeable shoe clutches • 19 anti-friction bearings on power shafts, clutch friction drums and sprockets on the clutch shaft alone • Hook rollers . . . with front 2 on special, anti-friction bearings • Truss-type turntable bed • E-Z Controls for effortless action, faster response • Usable as ¾-yd. shovel, crane, clamshell, dragline, hoe • Independent cable crowd on shovel • 2-piece pin-connected crane boom • Power load lowering is standard • Ability to back-down-the-load • Third Drum available • Precision boom lowering device for cranes.

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THE THEW SHOVEL CO., LORAIN, OHIO

ALCOA ALUMINUM PIPE replaces corroded steel in world's first permanent aluminum underwater oil pipeline

Welded section of 4-inch ALCOA Aluminum Pipe being lowered into Lake Maracaibo, connecting underwater well of Creole Petroleum Corporation to flow station. After double jointing on shore, only six and one-half hours were needed to complete the job from the time welding operations began on the construction barge until the pipe was laid, nearly 20 feet below the lake surface.

Seven hundred feet of uncoated ALCOA Aluminum Pipe was recently submerged in Lake Maracaibo, Venezuela, as a pilot installation of the world's first permanent aluminum underwater oil pipeline. Corrosion-resistant ALCOA Aluminum replaced steel pipe carrying crude oil from an underwater well to a flow station in Creole's Bachaquero Field. Experience had shown that the steel pipe's protective coating was attacked by an aquatic borer, the Teredo, exposing the steel to corrosive action of the lake's brackish waters.

ALCOA's successful five-year operation of an undersea aluminum gas line in Matagorda Bay, Texas, demonstrated aluminum's suitability for this type of application. Moreover, exhaustive tests conducted by ALCOA's Aluminum Research Laboratories indicated that certain ALCOA Aluminum alloys have the necessary resistance to salt water and crude oil corrosion to last many years at this installation.

ALCOA Aluminum Pipe has other advantages as well. It is light in weight for quick assembly and portability. It costs less per foot than any other corrosion-resistant metal pipe, and its ease of installation adds to its economy. Its nonsparking characteristic insures the safe handling of inflammables. Some sizes are available in more than one thickness to meet varying service requirements.

Compare the advantages of ALCOA Aluminum with the pipe you are now using. Write today for the new, FREE booklet, *Alcoa Aluminum Pipe and Fittings*, which gives valuable technical data plus complete information on cutting, bending and joining. Use the coupon.

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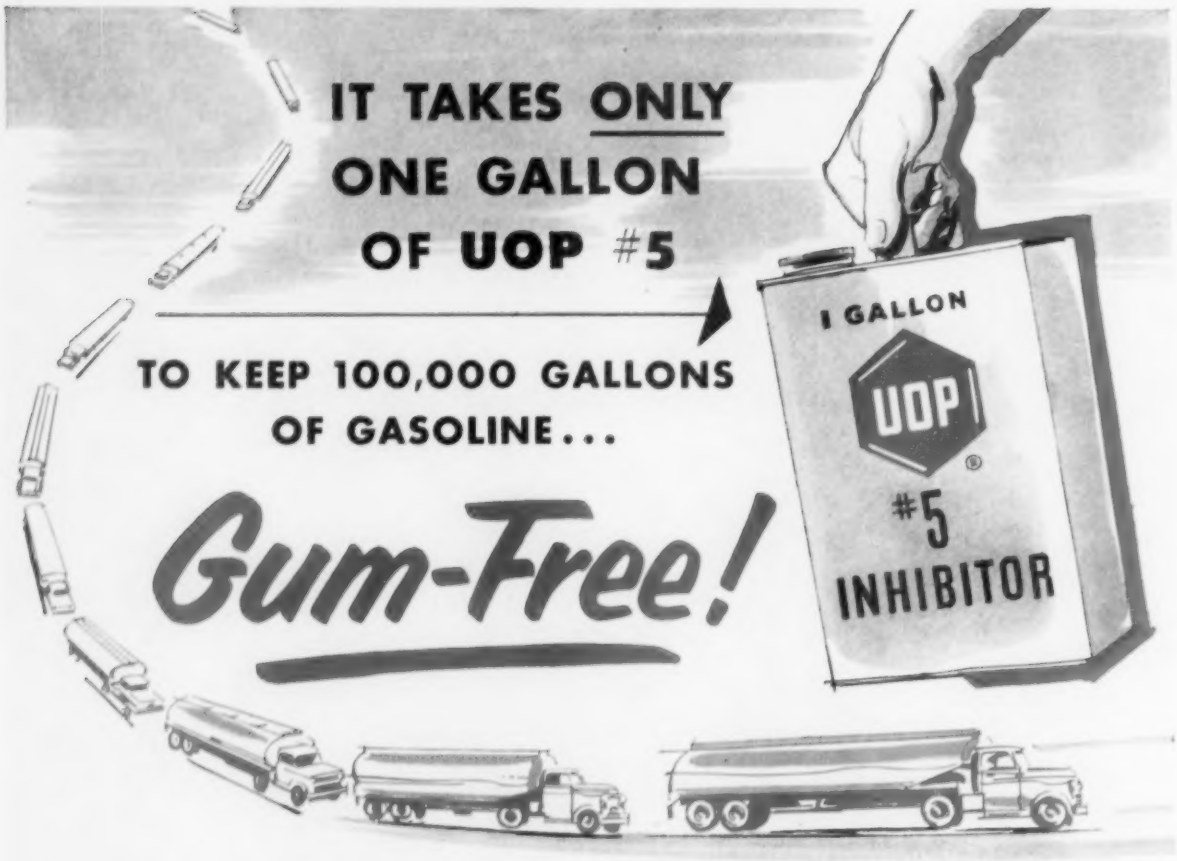
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA



UOP #5 Inhibitor is the most economical you can use. And by experience and test it is also the best—the only inhibitor that can handle the really tough stability jobs.

Actually, only 5 molecules of UOP #5 will protect as many as 1,000,000 molecules of today's tailor-made gasoline from the formation of gum, the one universally recognized cause of engine manifold deposits. It's effective, too, in preventing the decomposition of TEL in stored gasoline. Is it any wonder that UOP #5 is the standard of comparison in the industry?

Just as the methods of making better gasoline keep changing, so do the techniques of finishing gasoline for maximum gum stability and engine cleanliness. We will be glad to share our experience in this field with you in attacking a current stability problem or in reducing costs on present processing. Just write us.

PRODUCTS DEPARTMENT

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Hundreds of "Royal Scintillators" have been purchased by leading oil companies and independent geologists for use in investigating the radioactive "halos" surrounding oil fields. The purchasers of these units were so satisfied they demanded an even more sensitive instrument of the same type.

In response to this demand, a special Project team of engineers at Precision Radiation Instruments has developed the new Model 118-C with an enormous crystal measuring 7" in diameter, and with a sensitivity twelve times that of the original model 118 "Royal Scintillator." This instrument has a counting rate of six million counts per minute in a one MR/HR field of radiation. It's the finest instrument of its type in the world.

Those companies who have benefited from the sensitivity, accuracy and dependability of the Model 118 will certainly want to add the Model 118-C to their present geophysical equipment. Those who have not yet benefited from this advanced technique will want to start with the most sensitive instrument of its kind in the world . . . the "Royal Scintillator" Model 118-C.

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the future

For those who want a fine "Scintillator" at a moderate cost, PRI has also designed a successor to the famous Model 118. The new model 118-B "Royal Scintillator" has a 3¼" diameter crystal with twice the sensitivity and counting rate of the previous model. PRI's expanded production has made this improved instrument possible at no increase in price.

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The "Royal" is the finest instrument made for uranium prospecting, as well as investigating the radiation pattern around oil fields. Its use for this purpose should not be overlooked by oil geologists.

For further information contact your dealer . . . or write direct for free pamphlet "The Principles of Oil Field Detection with Scintillation Counters" and complete catalog of Geiger Counters and Scintillators.

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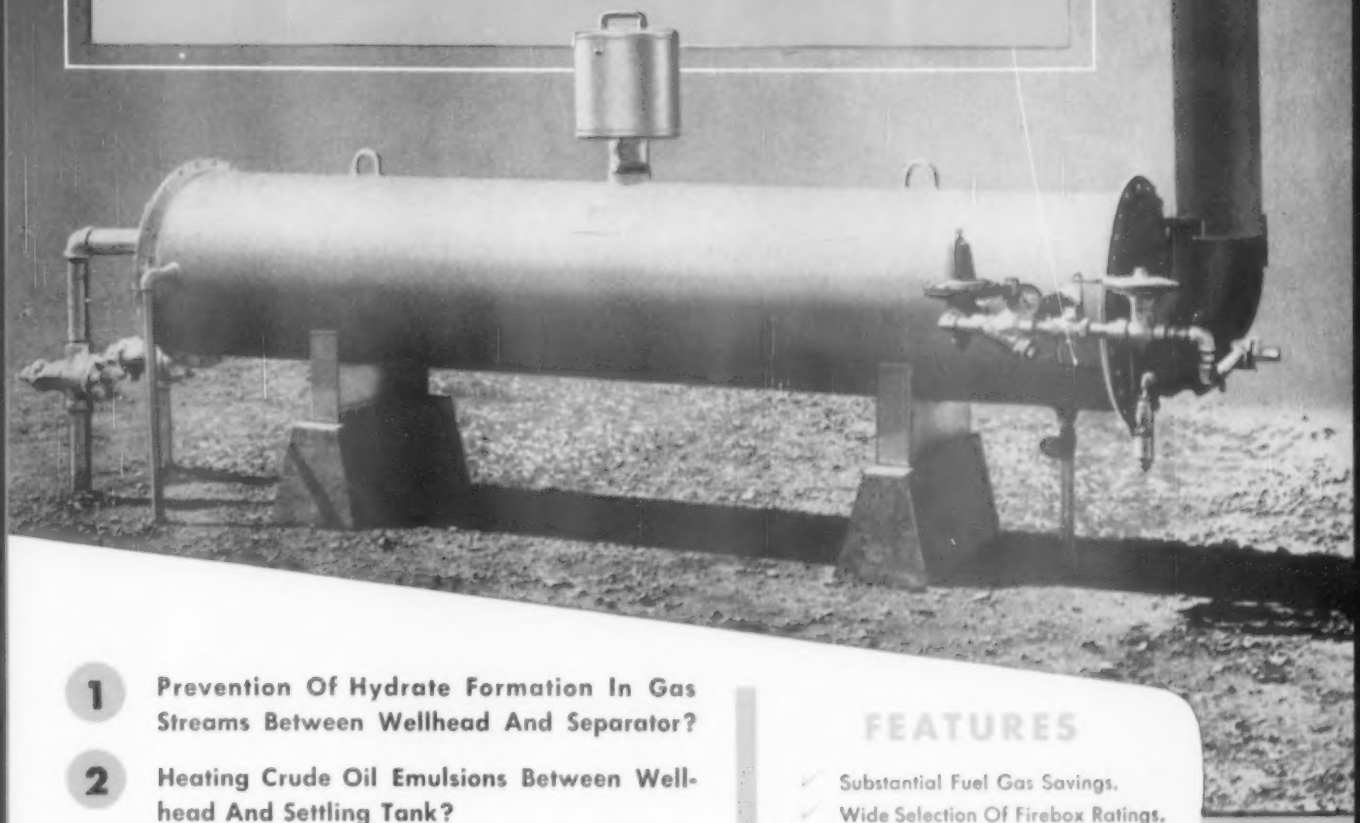

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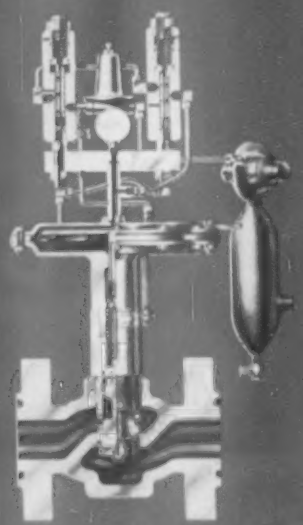
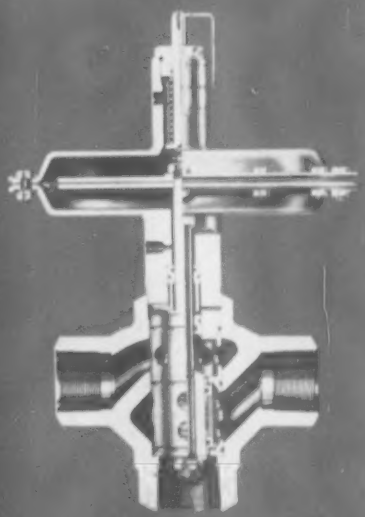
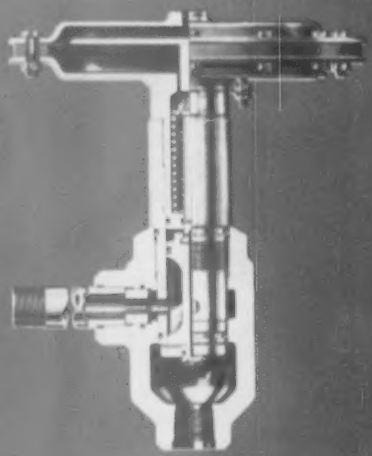


Type "DCB" High-Low Well Head Safety Valve, using Type "DCB-1" Motor Valve with Type "Y" Controller. Fully pressure balanced, for working pressures to 10,000 psi.



Type "CPC" 3-Position Soft Seat Motor Valve. Interchangeable inner valve converts to 2-position diverter valve.



Type "DCB-1" Angle Valve, 1" size. Fully pressure balanced. 1½" soft seat. Orifice sizes from ¼" to 1", determined by stellite choke downstream of inner valve. Pressure drop is taken across choke. Ideal for high pressure separators, dehydrators and other services where high pressure differentials prevail. Working pressure, 5000 psi.

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For complete information, write for new Catalog No. 256 MVC, or ask your GOT representative.

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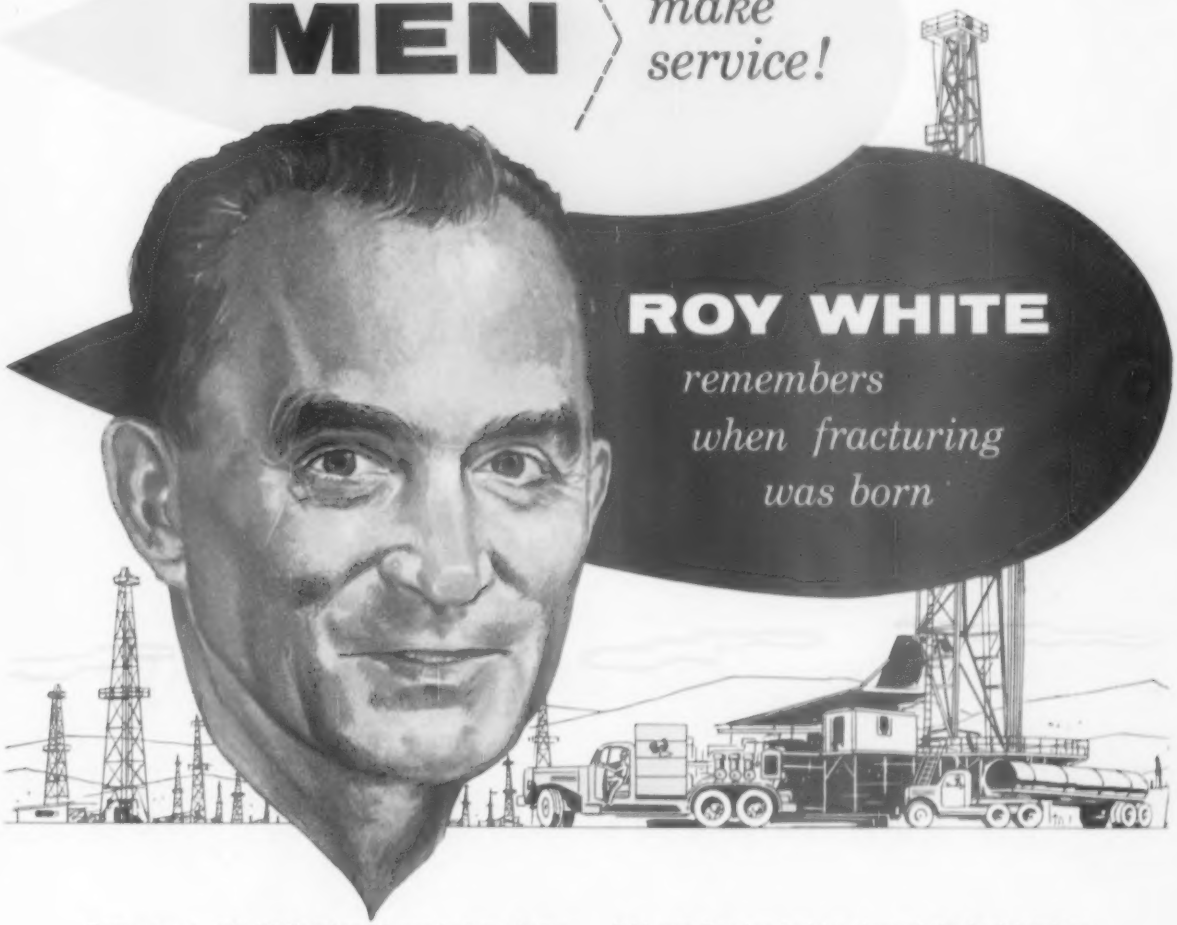

ROY WHITE *remembers when fracturing was born*

BACK IN THE early 1930's when oil men had just begun to investigate techniques for squeezing every drop of oil from a well, Roy White was "fracturing" wells even before the process was named. Roy worked with the pioneers in the Elk Basin of Wyoming who pumped oil at high pressures into well formations to try to crack loose additional oil flow. Present day fracturing is the outgrowth of these efforts.

In his more than 25 years in specialized oil well servicing Roy has participated in many "firsts" in techniques and developments . . . including the first gel-acid job in the Rocky Mountain region. And like all veteran field men Roy has had his share of the back-breaking, finger-freezing, forget-about-sleep jobs which are routine to service crews.

Roy is a good example of the type of men who make BJ Service. These field-proven veterans assure experienced direction on every job. Combined with the most modern equipment and the newest materials and techniques this knowledge helps you get specific results you want.

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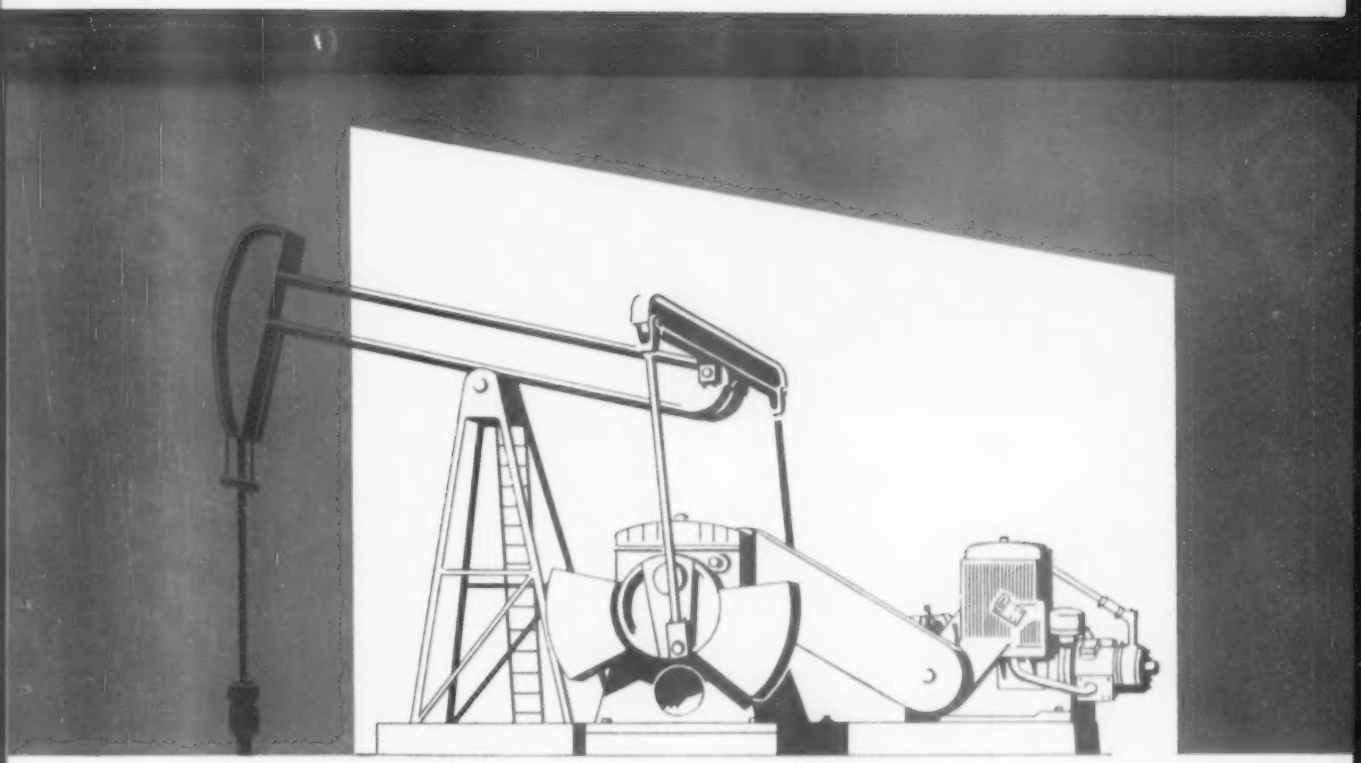

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PAST

The oil field manufacture-supply-service industry had its rudimentary beginning when the first oil well (the Drake well) was drilled in 1859 to a depth of 69½ feet. The first specialized oil tool manufacturer was a blacksmith who made the bits and other tools for this well. The supply company help came from stores that sold pipe and other heavy goods that could be adapted to this new use. There was no company to give expert service: what expertness there was came from men who adapted water well drilling knowledge to a brand new art — oil well drilling. With such makeshift methods, it is no wonder that this shallow well was brought in only after the most harrowing disappointments.

PRESENT

Today — three- and four-mile-deep wells are regularly, quickly, and efficiently drilled. There is little or none of the frustrating delay which attended the drilling of the Drake well.

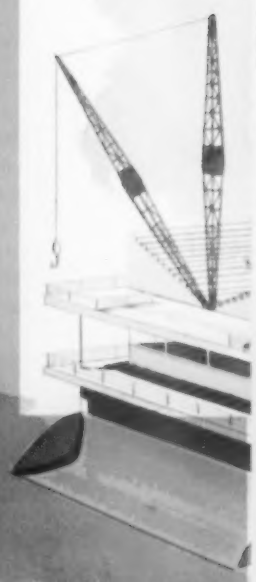
Now, manufacturers, supply companies, and service companies specialize in making equipment for finding, drilling, and producing oil. They apply the most advanced technology, developed by scientists working in every branch of knowledge.

How this specialized industry has grown since 1859!

511,000,000 MILES ARE TRAVELED each year by PESA members to serve their great customer, the mammoth oil industry.

9,000 RESEARCH SCIENTISTS, ENGINEERS, AND METALLURGISTS give valuable help in the application of equipment and service to drilling problems.

MULTI-BILLION-DOLLAR PLANT INVESTMENT: PESA members have invested their money in plants and equipment worth billions of dollars, in order to supply the oil industry with precision tools, equipment and services in such quantities that the customer gets them *when* wanted and *where* wanted.



Service Miles

prove that PESA members (manufacturers, supply companies, service companies) give EXTRAORDINARY SERVICE

FUTURE

(the creative engineers' today)

At the end of the next century, will the measure of the size of the manufacture-supply-service industry be in BILLIONS *of service miles? Or will it be in service hours by air?*

To most of us, the progress that will take place in the next century is almost beyond present-day imagining.

. . . but not beyond the imaginings of the men working in the research and development laboratories of PESA members. The future is the creative engineers' present.

Their probing minds are making the theories of today the commonplace of tomorrow: Automation . . . machines that guide, control, and almost think. Nuclear physics, applied to a far greater degree than at present, to finding and producing oil. Radioactive isotopes . . . controlling processes and detecting flaws. Metals that will make possible the drilling of wells to far greater depths.

Whatever the requirements of the future, the oil industry can be sure that the manufacture-supply-service companies will be ready with the products and services needed —thanks to the spur of keen competition among PESA members.

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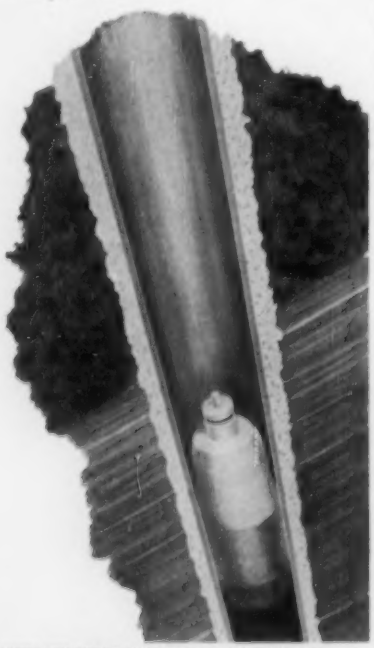
McCullough Bridge Plug Drills Out in Two Hours Forty-five Minutes

A 4½" O.D. McCullough Bridge Plug was set in 5½" O.D. casing at 2800′ to squeeze off a hole in the casing. Two previous attempts by other type plugs had not been successful.

Operator drilled out the McCullough Plug in two hours and forty-five minutes with a Reed Rock Bit that had previously drilled through 130′ of cement on top of the plug.

A production packer was then set below the point where the plug had been drilled out without difficulty of any kind.



SAVE RIG TIME! *McCullough Bridge Plugs run faster, set easier, drill out quicker.*

McCullough Bridge Plug Set at 12,420′ in Only 4 Hours

17.6 lb. Mud and 11,400 lb. Hydrostatic Pressure at Setting Depth No Problem for McCullough Bridge Plug

Typical of trouble-free operation under severe well conditions was the setting of this McCullough Bridge Plug in a deep Louisiana well.

Plug setting depth was at 12,420′ in 5" O.D. 18 lb. liner where it was necessary to do a squeeze job. Hole was full of 17.6 lb. per gallon mud and hydrostatic pressure at operating depth was approximately 11,400 lbs.

Because of its short length and small O.D. in relation to the inside diameter of the casing and liner, the 4" O.D. McCullough Bridge Plug was run through the heavy mud in a minimum amount of rig time.

Only four hours were required to complete the job including rigging up and tearing down.

During the entire operation there was no trouble, no delay of any kind. Since slips, reins, rubber packers and other moving parts have been eliminated in the McCullough Bridge Plug, there was no danger of hanging up and setting prematurely —even when entering the restricted I.D. of the 5" liner where a slip-type plug might have failed.

The McCullough Bridge Plug provided a leak proof, metal-to-metal seal at 12,420′ under the heavy hydrostatic load to the operator's complete satisfaction. The squeeze job was completed as a routine, trouble-free operation.

McCullough Bridge Plug Easily Passes Tight Spot in Casing

Due to the small outside diameter and short length of the McCullough Bridge Plug, it easily passed through a tight spot in the casing where a plug of another make failed.

Casing was 5½" O.D. 15½ lb. Plug setting depth was 3315′. A slip-type bridge plug was run, but would not pass through a tight spot in the casing at 130′. After this failure, a 4½" O.D. McCullough Bridge Plug was run. It passed the tight spot without difficulty and was securely set at the required depth—total time on the job; only one hour.

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Philco CLR-7 Microwave equipment can be installed in minimum space . . . employs reliable, long-life tubes, a positive frequency control system and is completely compatible with existing wire line and two-way radio facilities *and with any type multiplex equipment.*

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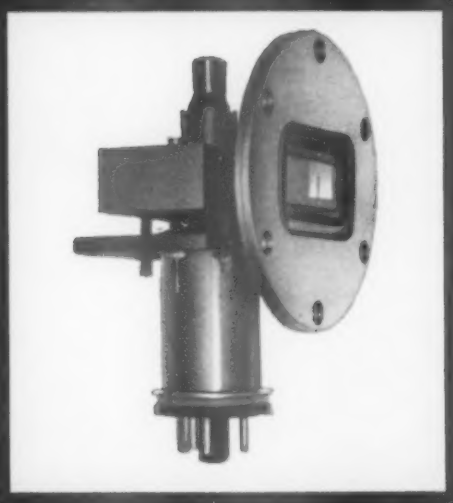

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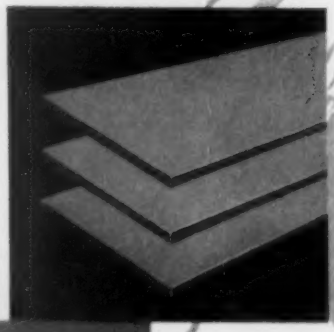

CF&I LECTRO-CLAD
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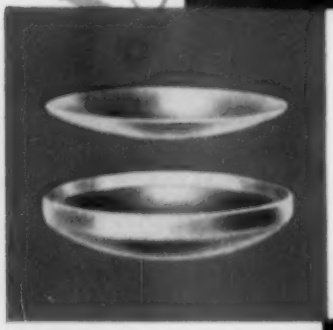

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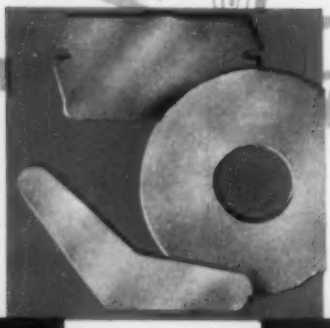
Flame Cut Steel
Plate Shapes



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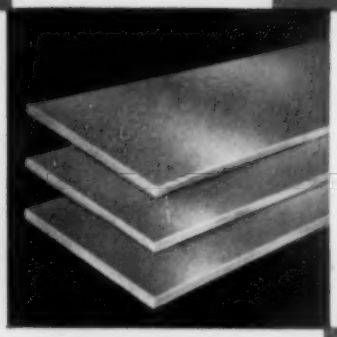

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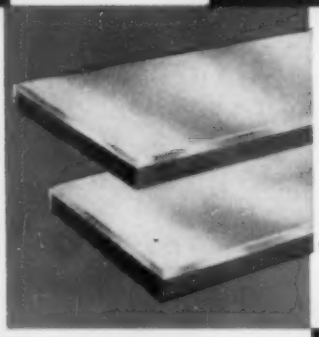

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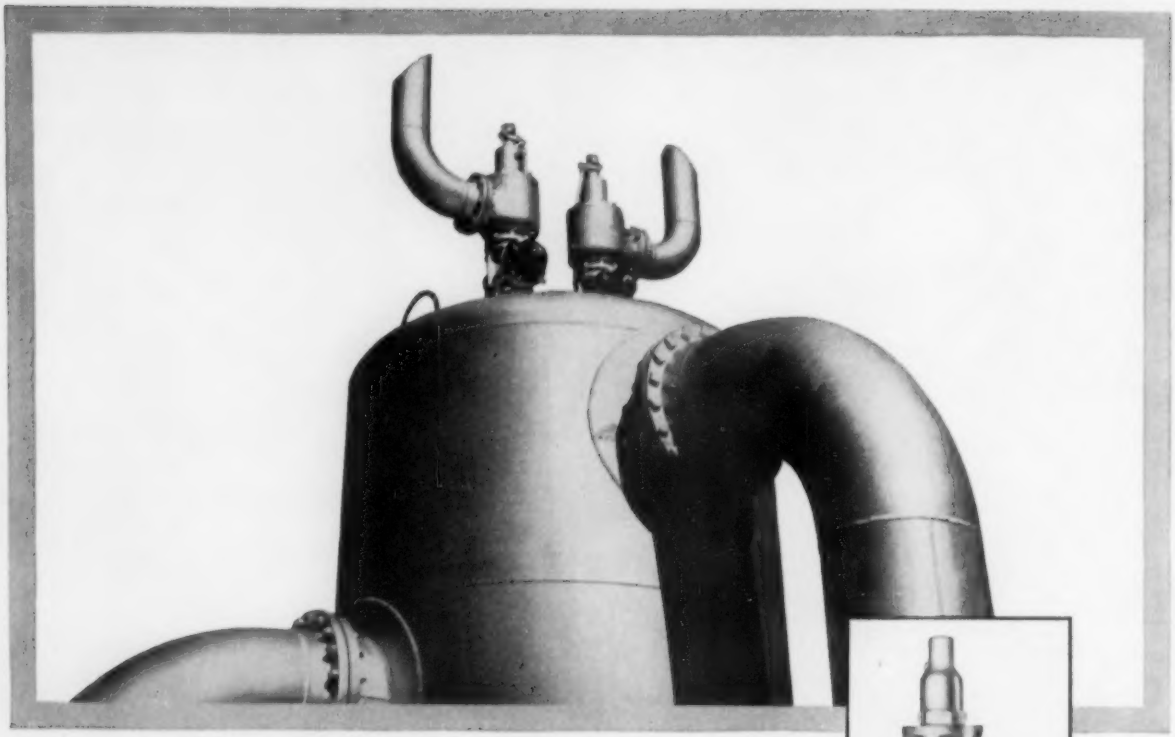

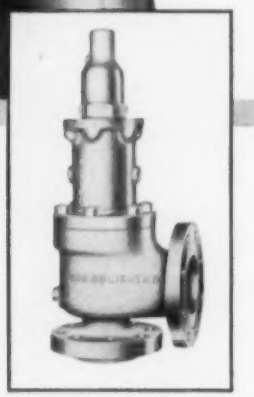

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CONSOLIDATED SAFETY RELIEF VALVES GIVE YOU ALL FOUR—AND MORE

Consolidated Safety Relief Valves satisfy *every* requirement of the most advanced processing facilities. Valve action is *consistently* positive. You get peak performance even where discharge lines are long or there is low "superimposed" back pressure in the relieving system!

The Standard type can be converted to Bellows type *in the field*. Center-to-face dimensions of inlet and outlet are such that you can interchange these valves with the safety relief valves of other manufacturers. Real flexibility of application that cuts inventory costs! Optically-ground flat seating surface and fewer functional parts than comparable valves contribute greatly to easier, more economical maintenance.

Get top economy and absolute protection with Consolidated Safety Relief Valves. Full range of sizes and pressures available. Write for Catalog 1900 for complete information.

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under API-ASME and ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

How **CABOT SHOPS, INC.** mounts the slow speed shaft of its Model AC pumping unit on Timken tapered roller bearings.

How TIMKEN® bearings hold shafts in alignment despite heavy loads— cut gear wear on Cabot pumping unit

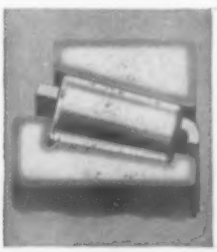
THE bearings on the slow speed shaft on this Cabot Shops, Inc. Model AC pumping unit face real problems. Since herringbone gears are used, the bearings must position all shafts. And since they're on the slow speed shaft, they must take heavy radial loads. To add to the problem, this equipment must run for years with very little attention. So the bearings must be practically maintenance-free.

To solve these problems, Cabot engineers specified Timken® tapered roller bearings in each gear box. Timken bearings are designed to do such tough jobs easily. Full line contact between rollers and races gives them greater load-carrying capacity. And tapered design lets Timken bearings take *both* radial and thrust loads or any combination. As a result, end play is minimized. Shafts are held in proper alignment. Gear wear is reduced. Because Timken bearings hold housings and shafts concentric, closures are more effective. Lubricant stays in—dirt and moisture stay out. Lubrication costs are kept way down.

One reason Timken bearings can take it month in and month out is that we make our own bearing steel. We're America's only bearing manufacturer that does. And we make the steel nickel-rich for added toughness.

To make sure you get all these advantages, specify Timken bearings on all the oil field equipment you build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



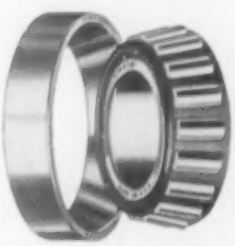
GREATER LOAD AREA

Because the load is carried on the *line* of contact between rollers and races, Timken bearings carry greater loads, hold shafts in line, wear longer.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. nickel-rich Timken alloy steels.

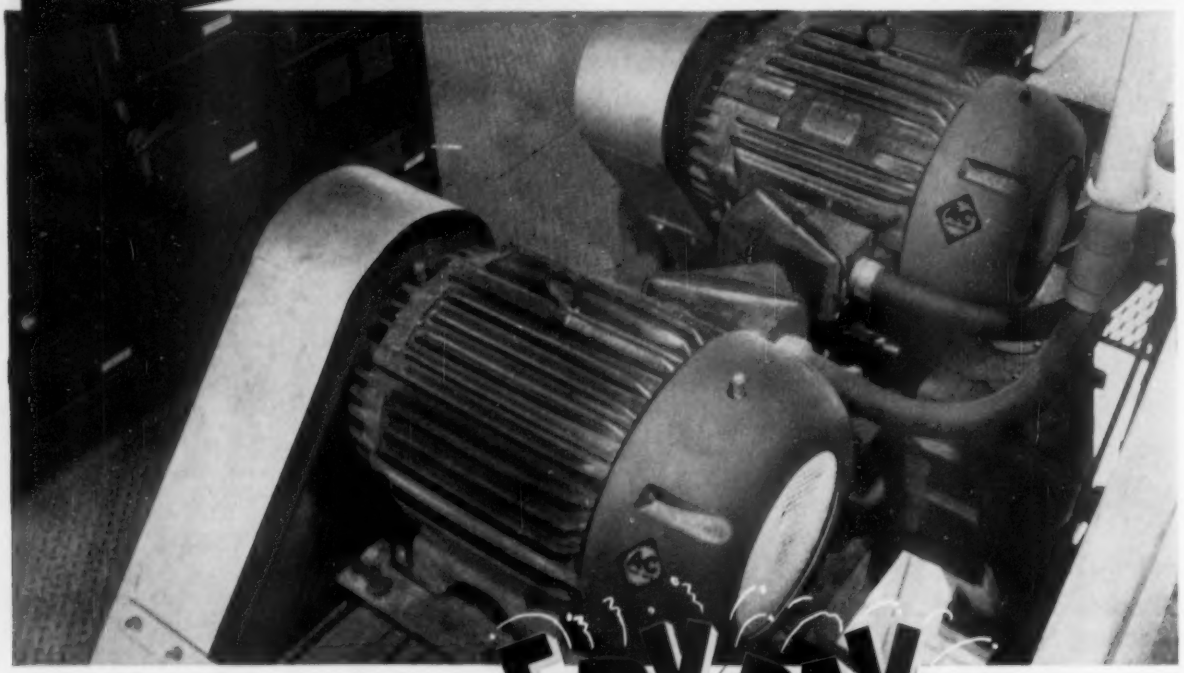
TIMKEN

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ∥ AND THRUST ⊥ LOADS OR ANY COMBINATION ✳

There's **MORE** Cooling Surface in these deep-ribbed **MOTORS**



No Day is FRYDAY

with these Allis-Chalmers MOTORS

● Frying of insulation is impossible under normal conditions with the extra-large cooling surface of Allis-Chalmers rib-type TEFC motors. The result—you expect and get longer motor life.

The engineered partner of A-C motors is Allis-Chalmers control.

Get Complete Information

As a new machinery component or as replacement, specify Allis-Chalmers. Discuss your particular application with your nearby A-C distributor, A-C district office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

FOR MORE INFORMATION AT THE BOTTOM OF YOUR WELL

Double Shut-In Pressure Readings Provide More Information — In Less Time — Than Other Methods

"WHAT IS THE main advantage of double shut-in pressure readings?" That's a question often asked by those who have not yet tried this newest method of drill stem testing.

Actually there are *four* main advantages of the double shut-in pressure method:

1. Maximum formation pressure build-up in shortest time.
2. Comparison of reservoir build-up pressures before and after test.
3. Two separate chances to obtain reservoir pressure.
4. The measuring of the true equilibrium pressure prior to producing the formation provides a virgin pressure measurement and more accurate data.

Perfected by Johnston Testers, this new technique requires only a simple rearrangement of the test tool assembly. By placing a disc valve above the main or hydraulic valve, a specified volume of air is trapped between these two valves. This volume of air is called the "air chamber."

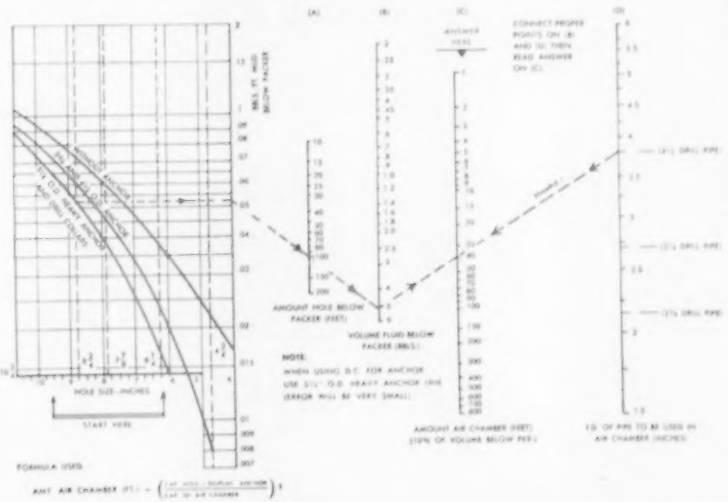
As the purpose of the air chamber is to relieve the mud pressure trapped below the packer, the secret of success of double shut-in testing is accurate use of this air chamber. Best results have been obtained when volume of the air chamber is about 10% of the volume of mud below the packer.

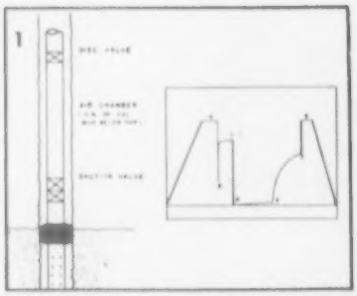
In the past, it has been common to calculate the air chamber to the nearest 30-foot pipe length. This lack of accuracy has often caused a failure to record the *maximum* initial shut-in pressure.

To overcome this problem, and to do away with complicated mathematics, Johnston has developed an "air chamber alignment chart." By simply drawing straight lines between known figures, the amount of air chamber needed can be calculated quickly and accurately.

The chart below shows how simple it actually is to use this method.

Complete information on double shut-in testing is available from Johnston Testers, Houston, Texas. Write today for complete descriptive folder.





Testing tool assembly for double shut-in pressure readings which permits a limited fluid withdrawal. By placing the disc valve above the main or hydraulic valve so that a specified volume of air is trapped between these two valves.

Well not capable of producing fluid fast enough to fill up air chamber and cause pressure build-up.

Mud did not expand enough to get pressure draw-down below the formation pressure.

Mud expanded and pressure draw-down was below the formation pressure. Well was able to flow enough fluid to fill up air chamber and build-up shut-in pressure.

JOHNSTON TESTERS

first in drill stem testing

DS551

HOUSTON, TEXAS

LOS ANGELES, CALIF. • CALGARY, CAN.

FORMATION AND CASING TESTING — JOHNSTON

OIL is a magic word in the search for peace and power among the peoples of the world. May we in Texas direct every effort for its wise and useful production.

You are cordially invited to consult with our oil and gas division.

THE CITY NATIONAL BANK

OF HOUSTON

CAPITAL AND SURPLUS 20 MILLION DOLLARS

Member Federal Deposit Insurance Corporation

Finally...

A CORROSION INHIBITOR THAT IS PERMANENTLY STABLE IN BRINE

ENDCOR 50

WHAT ENDCOR IS: It is a specific chemical treatment for control of corrosion in both sweet and sour wells. ENDCOR 50 is a strongly polar-type organic corrosion inhibitor incorporated in a non-oil-soluble, water-dispersible liquid carrier. ENDCOR 50 is not a salt. It is a stable molecular compound.

HOW ENDCOR WORKS: When introduced into the annulus of a producing well, ENDCOR 50 passes through the casing oil layer and rapidly disperses in the underlying brine. When thus dispersed, ENDCOR 50 will be preferentially adsorbed as an impervious film on metal surfaces of pumps, tubing, rods and flow lines—thus protecting them from corrosive elements in the oil or brine.

FULLY FIELD TESTED. The outstanding performance efficiency of ENDCOR 50 has been thoroughly demonstrated by standard laboratory methods as well as by extensive field tests.

Dearborn Chemical Company has been a leader in the field of corrosion prevention and water conditioning since 1887. During this time, Dearborn has supplied the oil field industry not only with NO-OX-ID Coatings and Wrappers for the protection of pipe lines, but also with boiler water and cooling water treatment in refineries.

Dearborn®

COMBATTING CORROSION WHEREVER IT OCCURS

MAIL THE COUPON for your copy of Dearborn Bulletin 5500. It gives all the facts on ENDCOR 50.

DEARBORN CHEMICAL COMPANY Dept. OG
Merchandise Mart Plaza, Chicago 54, Ill.

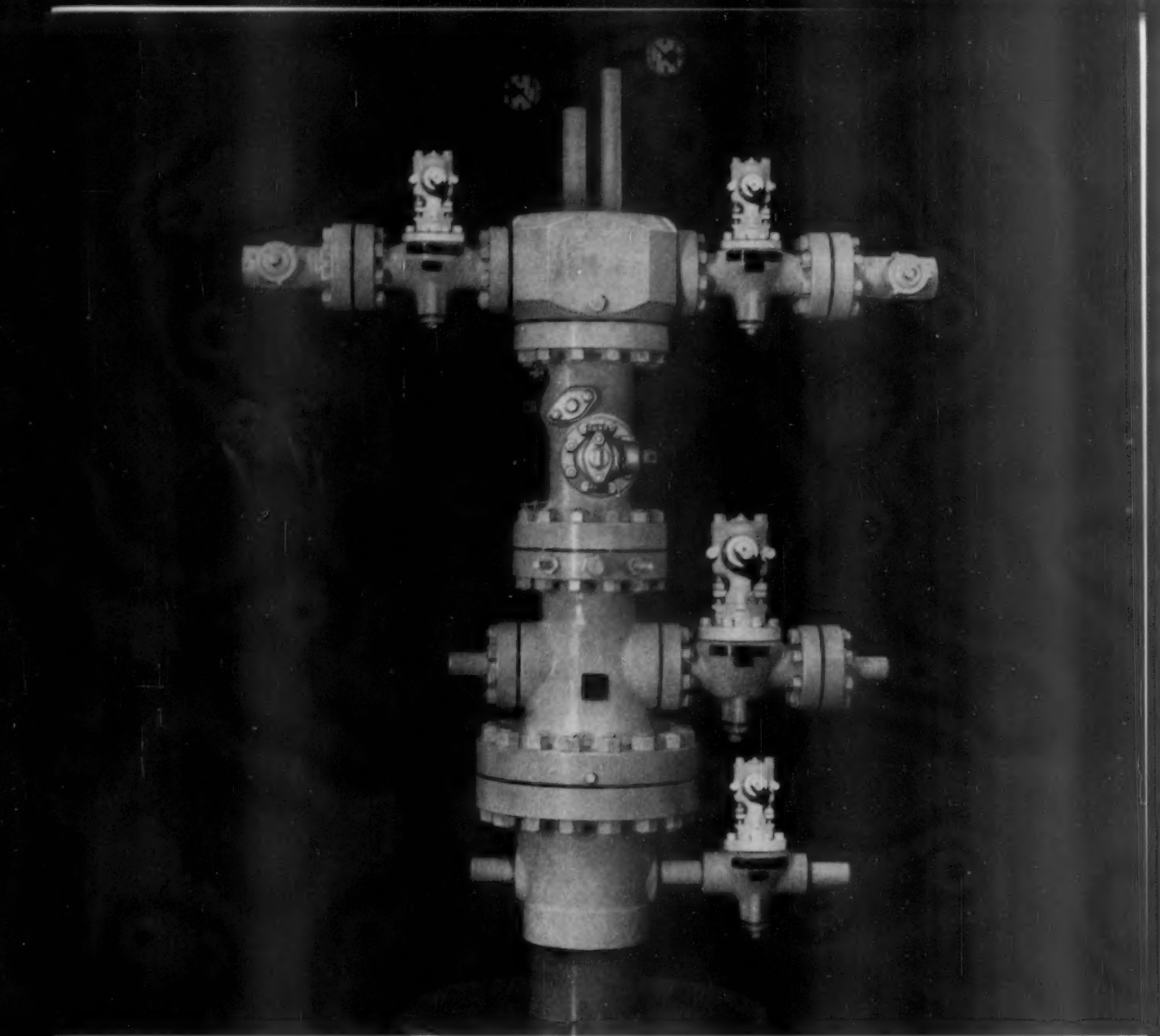
Gentlemen: Please send me Bulletin 5500.

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... ZONE..... STATE.....



Two Wells For The Price of One?

No not quite, but the economic advantage of producing from two zones simultaneously in a single well is obvious—and Cameron "DC" (Dual Completion) equipment is the most dependable protection for any producing condition.

To insure potential profits, do as thousands of successful operators have done—rely on the Cameron Closed-Pressure Method of Well Completion for utmost protection during this critical stage.

Cameron, the pioneer in multi-zone completion equipment, has now applied the many dependable features of the Closed-Pressure Method to the remarkable "DC" tree for parallel tubing strings. Suspension is completely versatile, permitting any work on either zone independently. Triple seals are the most advanced in the industry. The unique Cameron Non-Lubricated Master Valve employs the famous Lift-Plug components which may be replaced for a complete overhaul without removal from the tree and, of course, require no lubricants. The "DC" tee and caps permit every known operation to be performed with an absolute minimum of work.

Write or call to make an economical, flexible, complete completion.

Cameron

IRON WORKS, INC.

P. O. Box 1212 - Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

WORLD LEADER IN DEPENDABLE HIGH PRESSURE CONTROLS FOR THE OIL INDUSTRY

R/M *Poly-V® Drive*
Delivers More Power in Less Space!

No other belt drive can deliver as much power in the same space. It's R/M's patented Poly-V* Drive developed by R/M engineers after years of research. This totally new concept in power transmission delivers up to 50% more power than a conventional V-belt drive of equal width.

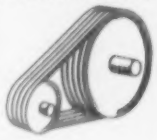
Unique design accounts for the unusual power capacity of R/M Poly-V Drive. A *single, endless* belt with parallel V-ribs runs on sheaves specially designed to mate precisely with the belt ribs. The uniform pull of this single unit belt distributes drive load evenly over the full width of the sheave . . . gives higher horsepower capacity per inch of drive width than ever before possible.

There are many advantages in this space saving drive . . . Poly-V has eliminated the matching problems of multiple V-belt drives, greatly increased the life expectancy of belts and sheaves and maintains more constant speed ratios under all loads. Just *two* cross sections of Poly-V meet every heavy duty power requirement . . . costly belt and sheave inventories are kept to a new low! R/M Poly-V Belts have strength members of superior synthetic cords, are oil-proof, non-spark and heat resistant.

Let an R/M representative demonstrate how you can improve your power transmission applications . . . get "More Use per Dollar" . . . with R/M Poly-V Drive. Contact R/M . . . or write for Poly-V* Drive Bulletin #6638.

CONDOR V-BELTS • R/M SUPER-POWER V-BELTS

Write for Bulletin #6868 on the complete line of Condor V-Belts for regular service on conventional V-belt drives. Also write for Bulletin #6628 on R/M Super-Power V-Belts with 40% more Horsepower capacity where needed.

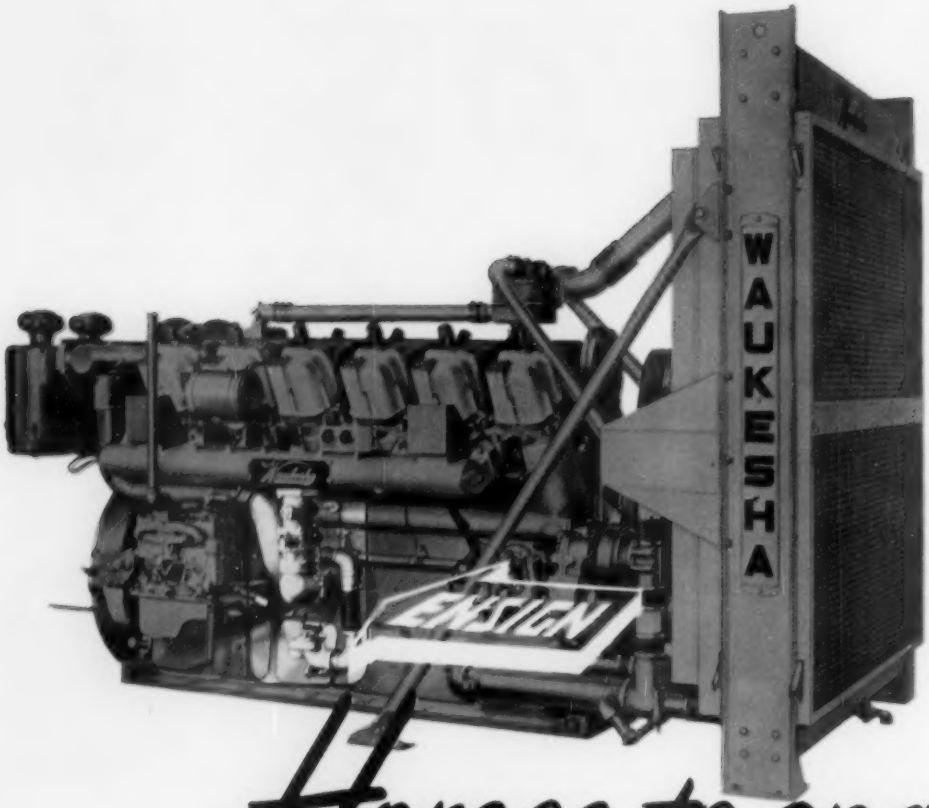


*Poly-V is a registered Raybestos-Manhattan Trademark RM 608

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

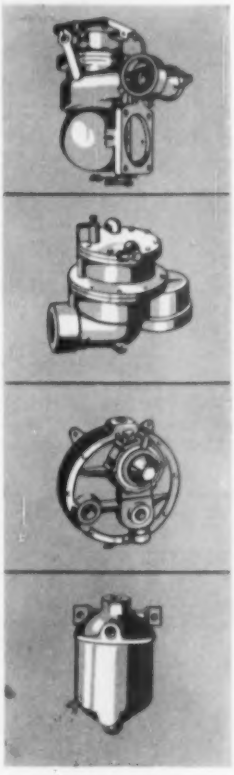


Horses to spare!

WAUKESHA V-12 GAS ENGINE

CARBURETED BY

Ensign



Naturally we at Ensign are mighty proud of this giant V-12 gas engine — the mammoth Waukesha VLROBU designed for Natural or LP-Gases. Easy starting, smooth idling, fast acceleration and sustained lugging power are engine characteristics closely related to carburetion. Waukesha and Ensign engineers worked together developing this high degree of engine performance.

Dual carburetion on this big Waukesha consists of an Ensign carburetor and regulator assembly installed on each bank of cylinders. To operate on LP-Gas the same Natural Gas carburetion shown above is used with the addition of an Ensign Vaporizer-Regulator and Liquid Filter.

ENSIGN CARBURETOR COMPANY

7010 SOUTH ALAMEDA STREET, HUNTINGTON PARK, CALIFORNIA

HUNTINGTON PARK, CALIF.

CHICAGO 36, ILLINOIS

LOS ANGELES 23, CALIFORNIA

DEALERS AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

They Say—

Defends Veto

Dear Sir:

It seems to me that you are unfair to the President when you say, "The Veto Was Illogical and Unfair" *(The Oil and Gas Journal, February 27, page 73).*

In 1952 President Eisenhower won the election on a platform of cleaning up the mess in Washington. We all admit that he has not been able to clean up the mess as much as we would like, but I see no reason why he should have created an additional mess by signing the Harris-Fulbright measure.

Some of our leaders in the oil and gas industry will have to learn that they cannot always buy everything they want. They will have to do a better job of selling the industry to the public.

The tidelands bill was another that could have been sold to the public and left a good feeling with the public, if a little more selling effort had been used rather than sit back and let Harry Truman and others convince the public that "the rich Texas oil man wants all the money from the tideland oil in his pocket."

Orlan L. Mullen
3726 Merrick Street
Houston, Texas.

Handle With Care

Dear Sir:

I enjoyed reading the article "Union Oil's New Relief and Blowdown Facilities" in your February 13 issue, of which I am a co-author. I wish to thank you and congratulate you for a very clear and pleasant presentation of the material.

A. J. Etingen
Project Engineer
Bechtel Corp.
San Francisco.

Engineers Protest

Dear Sir:

In reading your February 20 editorial, "Are Engineers Short or Do They Fall Short?" I was particularly annoyed by your statement: "Engineers themselves can better their standing as a whole by behaving like professional men rather than like either big shots or wage slaves. They should stay out of management if management is not really their forte."

The age-old dislike for engineers in management stems from the fact that an engineer is first a professional and second a business man.

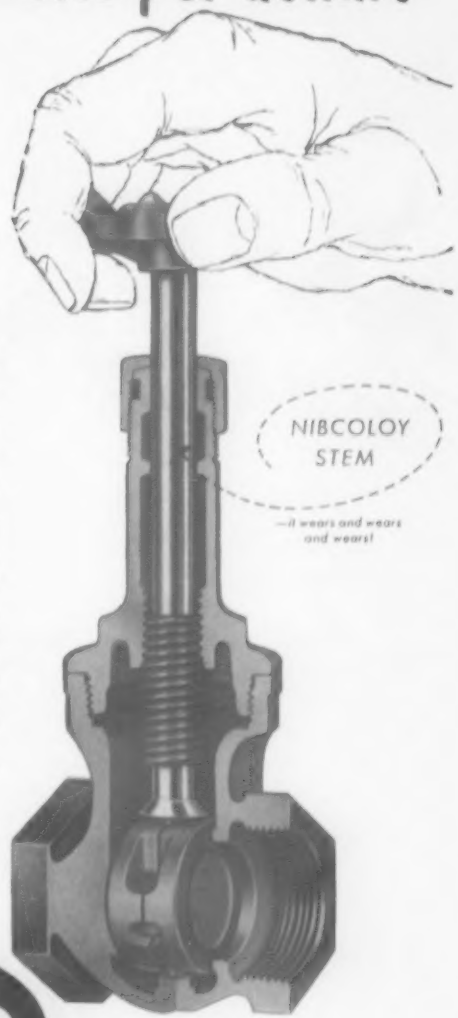
In being a profesisonal first, he must be concerned primarily with the public health and welfare. Only after he has satisfied himself with this aspect is he morally free to consider the profit side of the business. For this same reason, hospitals are largely supervised by doctors and law firms by lawyers. Ethics, to a professional, is much more than a word. The need for engineers in the management picture is likewise more than a phrase.

It is my opinion that your editorial has stated the problem in reverse. Why use nonengineer management in departments or firms where the first consideration should be the safety of the public, not the pockets of stockholders. To place profit above safety in this new atomic age is both dangerous and greedy. There is room for both safety and profit and the oil business in my opinion is far more safety-minded than many other industries.

The keynote of this disagreement can be summed up in your sentence: "What industry wants from engineers is what it wants from all its employes —ideas and results that will make money for the company, and keep it competitive and progressive." Haven't you forgotten something?

Joseph M. Dooling
South Airmont Road
Suffern, N. Y.

More shut-offs per dollar!



Globe or gate, solder cup or threaded . . . you get extra value with NIBCO pressure rated valves. That's because their Nibcoloy stems permit the cutting of accurate long-wearing threads, are high in tensile strength, and are non-corrosive. Then, too, valve bodies are 85-5-5-5 alloy in accordance with A.S.A. standards. In fact, NIBCO valves meet or exceed all performance standards . . . with SWP and WOG pressures clearly marked on side of the body. And they're made by valve specialists — in a plant devoted exclusively to the manufacture of valves.

SEND FOR FREE CATALOG NVC-2

Illustrated catalog gives specifications for all popular types and sizes.

Northern Indiana Brass Co.,
Elkhart, Indiana

NIBCO

PRESSURE RATED VALVES

O.K. BOYS BREAK IT UP!

Even after sedimentation, separation and chemical treatment of slop oils and refinery waste, you wind up with a knotty problem, that is, a highly stable interfacial emulsion. This is difficult to break, with too much oil in it to lose and too much contamination to allow discharge to waste. That's common knowledge.

But, today, a number of refineries have proved that this problem is easily solved by filtration with Dicalite Filteraids. Dicalite breaks this tough emulsion in two ways. First, the fine solids that help to stabilize the emulsion are filtered out. Second, the oil and water globules are ruptured as they pass through the filter cake. The filter effluent readily separates into oil and water layers... the oil is, of course, already "upgraded"

for easier reprocessing, the water is so free of oil (only 2 ppm were found in one State Waterways Authority check) that it may be discharged to waste without danger of stream pollution, or re-cycled for process water in some cases.

Dicalite filtration of refinery wastes recovers 5,300-5,900 bbl. of oil per month for one refinery, making it a highly profitable operation. Others report that oil recovery will pay for the entire filter installation in two years, and then probably show a profit.

Why not investigate the advantages Dicalite filtration can give your operation – write us!

Dependable GLC GREAT LAKES Dicalite® DIATOMACEOUS MATERIALS

DICALITE DIVISION: GREAT LAKES CARBON CORP.
612 S. FLOWER ST., LOS ANGELES 17, CALIFORNIA

Objection from Wyoming

Dear Sir:

The Wyoming Section of the American Institute of Mining, Metallurgical, and Petroleum Engineers protests your untimely and unwarranted attack on engineers in your editorial, "Are Engineers Short or Do They Fall Short?" in your February 20, 1956 issue.

We do not believe any group, or profession, should be immune to criticism, however, in your enthusiasm to call a spade a spade we are afraid you buried the pick right between the shoulder blades. Certainly no one can accuse engineers of being a sensitive group and given to passing resolutions protesting imagined slights.

The A.I.M.E. as the national organization for petroleum engineers is dedicated to improving engineering as a profession. We are particularly disturbed at your implication that the rush of the oil industry in the last few years to grab engineers is poor business judgment. Here we stand 180 degrees apart.

As engineers we feel recognization is belated and overdue, and that management is finally taking action to utilize the full potential of engineers. Your opinion that engineers should stay out of management, ruts, and routine jobs sort of restricts engineers to a narrow field.

Your concluding sentence was "Engineers' Week is a time to attack the alleged shortage—and alleged sad plight —of engineers from all angles." May we paraphrase this to more closely fit the tone of your editorial, "Engineers' Week is a time to attack engineers from all angles and examine the alleged shortage."

John A. Fraher
Secretary
Wyoming Section, A.I.M.E.
Casper, Wyo.

Editor's Note: Criticism of engineers in general was not intended. This "failure to communicate" was probably caused by trying to cram too many thoughts into a few words. The general idea of the editorial was that the law of supply and demand, plus more attention to education, should cure the engineer shortage in time.

In the meantime, the shortage should be tackled like a shortage of pipe—by concentrating engineering abilities on engineering problems and developing "substitute materials" (nonengineer personnel) for the other jobs. Engineers can help in this if they don't have a false notion of the value of an engineering degree per se.

Management isn't the "forte" of every engineer, and some engineers pushed into management would be happier and more productive back in engineering. Management should make it profitable

for engineers to stay in engineering work if that's where their talents really lie.

CALENDAR

MARCH

29-30 American Institute of Mining, Metallurgical, and Petroleum Engineers, Dallas section, conference on economics and valuation, Statler-Hilton Hotel, Dallas.

APRIL

2-3 Petroleum Engineering Conference on electrical and radioactivity logging, University of Kansas, Lawrence, Kans.

3-5 Annual Corrosion Control short course, University of Oklahoma Extension Study Center, Norman, Okla.

4-6 American Gas Association, general management conference, Conrad Hilton Hotel, Chicago.

4-6 American Petroleum Institute, Division of Production, Mid-Continent District meeting, Broadview Hotel, Wichita, Kans.

4-6 Society of Lubrication Engineers, eleventh annual meeting and exhibit, Wm. Penn Hotel, Pittsburgh.

8-13 American Chemical Society, general meeting, Dallas.

9-10 Texas Petroleum Research Committee, Ninth Oil Recovery Conference (Symposium on Natural Gas in Texas), Texas A. & M. College, College Station, Tex.

11-13 Natural Gasoline Association of America, Texas Hotel, Fort Worth.

14-15 Southern Gas Association, conference on use of electronic computers by engineering personnel, Hilton Hotel, El Paso.

14-18 Petroleum Equipment Suppliers Association, annual meeting, Boca Raton Hotel & Club, Boca Raton, Fla.

15-17 Texas Independent Producers and Royalty Owners Association, Statler Hilton Hotel, Dallas.

16-18 American Society of Mechanical Engineers, first Gas Turbine Power Conference, Hotel Statler, New York.

17 American Institute of Chemical Engineers, Philadelphia-Wilmington section —University of Pennsylvania, fourth annual meeting of "Experience in Industry" series.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

18-20 American Petroleum Institute, Division of Production, Rocky Mountain District meeting, Cosmopolitan Hotel, Denver.

18-20 National Petroleum Association, semi-annual meeting, Cleveland Hotel, Cleveland, Ohio.

19-20 Third Annual West Texas Oil Lifting Short Course, Texas Technological College, Lubbock, Tex.

23-25 Southern Gas Association convention, Dallas.

23-26 American Association of Petroleum Geologists and Society of Economic Paleontologists, annual meeting, Conrad Hilton Hotel, Chicago.

24-25 Pacific Coast Gas Association, Supply and transmission conference, Thunderbird Hotel, Las Vegas, Nev.

25-27 American Petroleum Institute, Division of Production, Eastern District meeting, Deshler-Hilton Hotel, Columbus, Ohio.

25-29 World Oil Exposition, Houston.

26 Panhandle Producers and Royalty

Joe Roughneck is the guy who gets the job done in the oil industry. He may be on a rig in the oil field or directing far flung operations from a plush office . . but he knows oil . . and pipe . . and he's the backbone and the symbol of the petroleum industry.

For Joe's personal convenience . . Lone Star's completely integrated steel mill is turning out API casing, tubing and line pipe of the highest quality. Joe likes to do business with the home folks at Lone Star where the largest mill stock in the Southwest is maintained and fast delivery is routine.

Neighbor, wherever you are, specify Lone Star and we both get a good deal!

Lone Star STEEL COMPANY

LSS

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DISTRICT SALES OFFICES
Houston, Texas | Midland, Texas | San Antonio, Texas
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New ...a powerful weed and grass killer prevents regrowth!

UREABOR*

*TRADEMARK OF BORAX CONSOLIDATED, LIMITED

You get Full Season's Control from One Application!

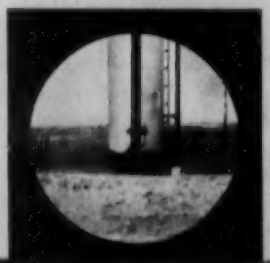
Only barren soil is safe from fire and other hazards! UREABOR destroys most all vegetation...for long periods. As little as 1 to 2 lbs. per 100 sq. ft. does this. Such low application rates mean savings on labor and storage space. UREABOR Weed Killer is always ready to use—DRY. Broadcast it by hand for spot treatments...use the handy new PCB Spreader for larger areas.

APPLY DRY

The new PCB Spreader is made for easy and efficient application of Ureabor. Available at $10.75—delivered—anywhere in the U.S.A.

Use UREABOR to destroy vegetation about fence lines, well sites, pipe lines, refinery buildings, heater units, tank batteries, and all places where ground must be kept bare.

Write for literature today!



NOTHING TO MIX

NO WATER TO HAUL

NONPOISONOUS
When applied as directed

NONCORROSIVE
To ferrous metals

AGRICULTURAL SALES DIVISION

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

630 SHATTO PLACE • LOS ANGELES 5, CALIFORNIA

MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

Owners Association, annual meeting, Herring Hotel, Amarillo.

26-27 Eleventh Annual Management Engineering Conference, sponsored jointly by Society for Advancement of Management and management division, American Society of Mechanical Engineers, Hotel Statler, New York.

30-May 1 Independent Petroleum Association of America, semiannual meeting, Statler Hotel, Los Angeles.

29-May 1 Pennsylvania Petroleum Association, annual meeting, Bedford Springs Hotel, Bedford Springs, Pa.

30-May 2 American Geophysical Union, thirty-seventh annual meeting, Washington.

30-May 5 International Course on Atomic Energy, sponsored by National Industrial Conference Board, Westchester Country Club, New York.

MAY

1-3 Petroleum Industry Electrical Association, annual meeting, Statler-Hilton Hotel, Dallas.

6-9 American Institute of Chemical Engineers, Roosevelt Hotel, New Orleans.

7-8 Gas Compressors Institute session, sponsored by University of Kansas and Southwest Kansas petroleum industry, Liberal, Kans.

7-11 American Welding Society, annual spring meeting, Hotel Statler, Buffalo.

9-10 Symposium on control of corrosion in the chemical industry, University of Buffalo.

9-10 National Association of Corrosion Engineers, Niagara frontier section, symposium on control of corrosion in the chemical industry, University of Buffalo.

10-11 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Statler Hotel, Los Angeles.

10-11 American Gas Association, Gas Supply, Transmission, and Storage Conference, Conrad Hilton Hotel, Chicago.

13-16 American Petroleum Institute, annual pipeline conference, Shamrock Hilton Hotel, Houston.

13-15 Empire State Petroleum Association, Statler Hotel, Buffalo.

14-15 American Institute of Mining, Metallurgical & Petroleum Engineers, Kansas regional meeting, Broadview Hotel, Wichita.

14-16 American Petroleum Institute, annual pipeline conference, Shamrock Hotel, Houston.

14-16 Petroleum Electric Power Association, eighth annual convention, Robert Driscoll Hotel, Corpus Christi.

14-17 American Petroleum Institute, Division of Refining, midyear meeting, Montreal.

16-18 American Gas Association, Chemical Engineering, and Manufactured Gas Production Conference, Benjamin Franklin Hotel, Philadelphia.

17-18 Rocky Mountain Petroleum Sections, joint meeting, Gladstone Hotel, Casper, Wyo.

22-24 Pennsylvania Gas Association, Pocono Manor Inn, Pocono Manor, Pa.

24-25 Natural Gas and Petroleum Association of Canada, Sheraton Brock Hotel, Niagara Falls, Ont.

24-25 Western Petroleum Refiners Association, Michigan Regional Meeting, (location to be announced).

24-25 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington, Ky.

28-30 Chemical Institute of Canada, 39th annual conference and exhibition, Sheraton-Mount Royal Hotel, Montreal.

30-June 1 Texas College of Arts & Industries, eleventh annual short course in Gas Technology, Kingsville, Tex.

30-June 2 Interstate Oil Compact Commission, Dallas.

JUNE

3-8 Society of Automotive Engineers, summer meeting, Chalfonte Haddon Hotel, Altantic City, N. J.

6-8 American Society for Quality Control, tenth annual convention, Palais du Commerce, Montreal.

10-15 American Petroleum Institute, Production Division midyear standardization conference, Brown Palace and Cosmopolitan Hotels, Denver.

11-15 American Institute for the Advancement of Science, Gordon Research on Conference on Catalysis and Petroleum, Colby Junior College, New London, N. H.

13 Pennsylvania Grade Crude Association, thirty-third annual meeting, Bradford, Pa.

17-22 American Society for Testing Materials, annual meeting. Chalfonte-Haddon Atlantic City, N. J.

17-23 World Power Conference, Vienna.

21-22 Western Petroleum Refiners Association, regional technical—industrial relations meeting, Broadview Hotel, Wichita.

21-23 American Association of Petroleum Landmen, annual convention, Denver.

24-25 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que

26-29 Canadian Gas Association, Manoir Richelieu, Murray Bay, Que. (see book).

28-30 Rocky Mountain Oil and Gas Association, board of directors, Hotel Utah, Salt Lake City.

SEPTEMBER

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

23-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Statler-Hilton, Dallas.

OCTOBER

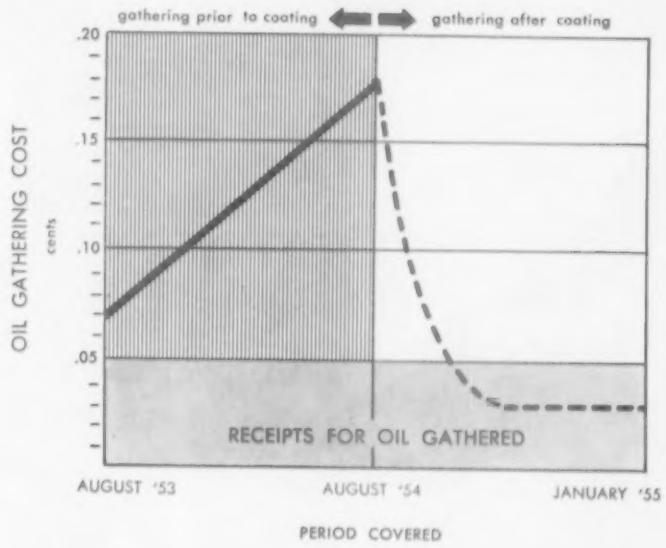
2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.



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Approximately 39,000 feet of pipe in a sour crude gathering system was internally coated with vinyl. Only main stems were coated. Cost was approximately $14,000.

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Figures represent all operating costs.

Since the company received only $0.05/bbl. for gathering the oil, repairing the lines and preventing further deterioration converted loss into profit. Since approximately 2,000 barrels of oil is gathered per day, at the $0.07 figure the yearly loss would be $14,600. On the basis of $0.037/bbl.—the present profit is $9,500 per year. Operating costs dropped from $360 per day in July, 1954, to $74 per day in January, 1955—a saving of $286 per day.

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JOURNALLY SPEAKING . . .

Waste Makes Taste

OUT in what used to be called the wastelands of Southwest Texas, a once-waste petroleum product is turning a waste plant into tasty feed for wasted cattle.

The jeep-riding cowboys out there, we are told, use propane torches to burn the spines off cactus. A quick pass of the hot flame leaves the juicy, succulent plant bare of its natural defense, and the cattle, who recognize the roar of the torch as the dinner bell, crowd around to gobble it up almost before it cools. It doesn't take a smart cow long to develop a taste for fresh broiled cactus cutlet.

Cactus is about the only plant that thrives during a drought in those parts. And every time a leaf gets knocked onto a bare patch of ground it mothers a new clump. So gradually cactus was taking over the ranges. It's long been a problem. Luther Burbank, the plant-breeding wizard, tackled it by developing a spineless cactus, but while it brought him fame his cactus failed to crowd out the wild, prickly kind.

Oil-burning torches were tried, but the soot and oil residue made the cactus unpalatable and the cattle sick. Then propane, which not so long ago was a waste product itself, turned the trick. By the time the torches and the dogies get through with a clump of cactus there's nothing left but bare ground which will grow back to grass when the rains come.

Chalk up another one for petroleum progress.

The Inscrutable Orient

ONCE in a blue moon one of our subscribers will get sufficiently enthusiastic or provoked about our favorite oil publication to write in a suggestion for improvement. We're always glad to get them, even though the suggestions may be impractical. For instance, like this one from a Japanese reader:

"I have been subscribing the Journal for 3 years now. I have been interested in Technology-Operation section. They have been very much of use to me. So I be very much pleased if you kindly plan to have annual index (issue). It increases our readers' efficiency and saves time. Annual index might be one issue or two in a year. Quite all right even if one or two regular issues are replaced by them."

Now if this Honorable Subscriber had not confined his reading to technical articles but had even skimmed through other parts of our issues during the first couple of months of each year, he would have seen repeated notices that our annual index was printed as a separate booklet, available to anyone for the asking.

By printing the index separately there is no need to have it replace one or two regular issues a year. This might not be quite all right with the bulk of our subscribers, because we find that only about one-third of them write in for the index.

Our Nipponese friend was rushed a copy of our latest index, for even though the supply is getting low we still have a few more left. So if you too missed our earlier announcements you may still get a copy if you act promptly. Also, we're telling you now, as that Japanese engineer was told, that you can have your name put on our permanent mailing list to receive a copy of our index every year as soon as it's off the press and without the bother of writing in for it again.

Useful Eye

WHAT you are now readyng may seem strange, and ef so et's because just as we fynyshed typyng the above eytem the "eye" key flew off our typewryter. Seence eet ees kynd of hard to fynd words that don't have an "eye" een them, we asked the offyce manager for emmedyate repares, but he refused ayd because he sed eet was our fault for overworkyng the vertcal pronoun.

We explayned thees ees empossble seence we always use the edytoryal we, and never use the captal "Eye" unless eet ees an enyshul. As all the other macheens were beeng used, we tryed to feenysh the column wythout usyng any "eyes." We thought of substatutyng a "j" ljke the Dutch or Norwegeans, but jt djdn't look rjght. Usyng a "y" lyke yn old Englysh ys all ryght at tymes, but at others eet ees necessary to affect a Spaneesh accent, or even to go to phonetec spellng. Theos weel geeve our preenters feets. Anyway, thys proves that the eye ees a very useful letter even when not used as a capytal.

—*Henry D. Ralph.*

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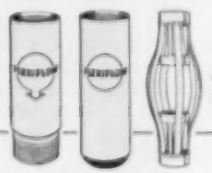

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BAKER FLEXIFLOW

Detail on reserves would be helpful

HERE we go again on the A.P.I.-A.G.A. reserve figures. Last year the Journal editorially suggested that the committee explain some features. Apparently we didn't do it very well because some readers misinterpreted our purpose. So we'll make another attempt to state our point because we think it's one that will help the industry.

Our point simply is that the industry would be served better if the committee would give a few more details from its work sheets and a little more explanation of its methods and conclusions.

Here are the nation's top reserve estimators giving their collective judgment. But nearly every oil and gas operator makes his own reserves estimates for certain areas. If the two sets of estimates should show important differences, the operators may wonder why they are so far off from the committee experts.

WE UNDERSTAND, of course, that all reserve figures are only educated guesses. That's why all the guessers would like to have more education. And everyone will admit that it is necessary and proper to revise earlier estimates—either up or down—almost every year on the basis of more recent facts. So we can't see any reason for not giving a frank explanation of the more significant revisions.

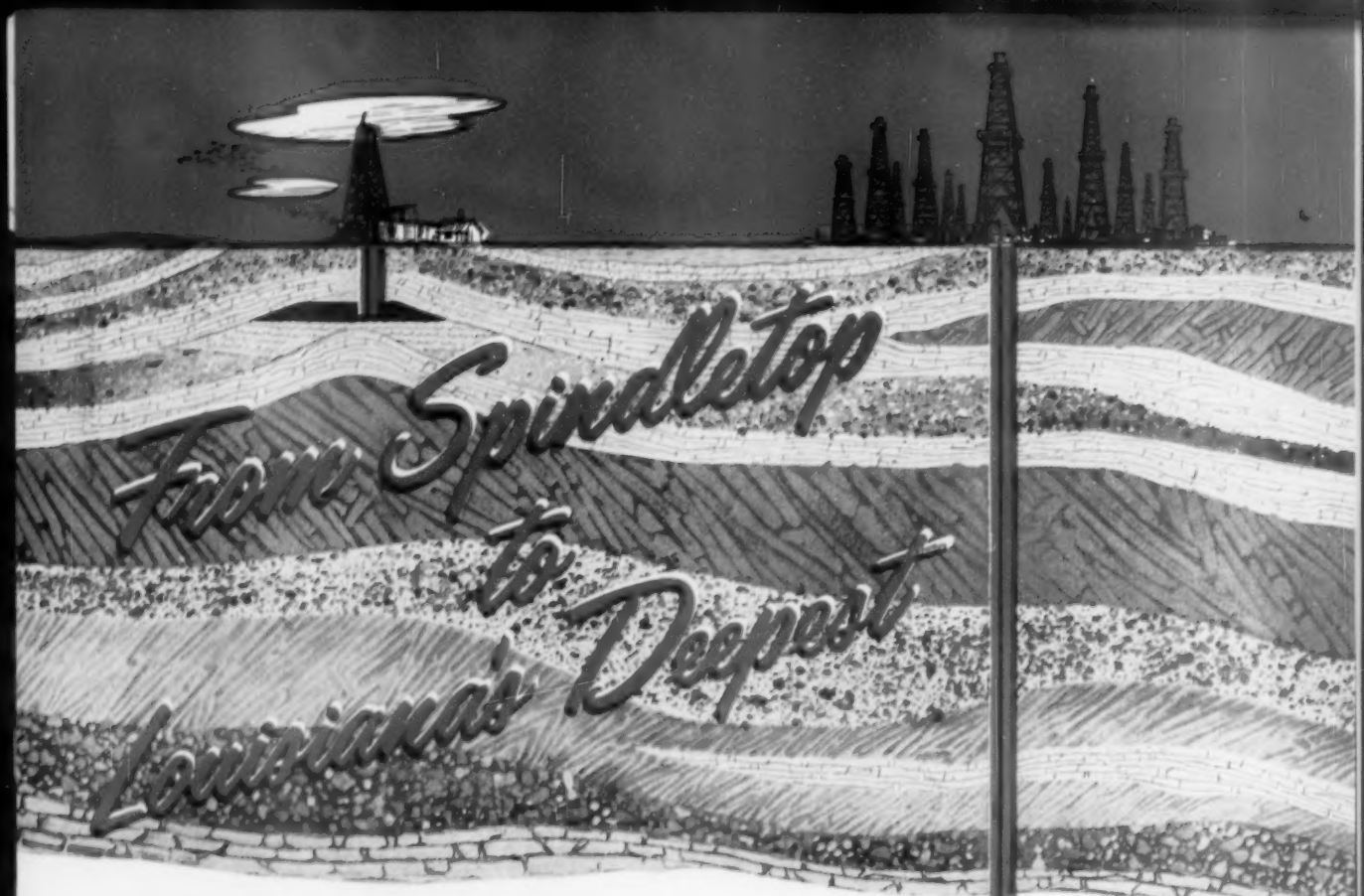
The committee's primary aim is to show the national reserves picture as of a given date. But in recent years the reports have been put to a great many other uses, and we think that the committee ought to release enough information to prevent the figures from being used for false conclusions.

One big help would be to separate "extensions" from "revisions," and list them individually by states (and by districts in big states). Operators and researchers would then have some basis for relating extensions to the rate of development drilling and to progress in recovery techniques.

For instance, people will persist in hunting for trends in correlation of drilling and reserves. Separation of extensions from revisions plus some explanation of the factors and weightings used would aid both operating oil men and industry analysts.

MOST OIL COMPANIES have their own estimates of reserves in certain areas, and many have a working rule of thumb for forecasting reserves per well drilled. When these individual estimates are out of line with the committee's, the operators would like some means of checking their own judgments against the committee's collective reasoning.

So all the Journal is asking is a little more detail and discussion about the admittedly speculative process of estimating reserves. We think this would help the industry. If that's being critical, we mean it as constructive criticism.



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The Industry This Week

Industry

• **Expect a 4.4 per cent increase** in domestic demand this year. That's the average reported by top brass of the oil industry in an unusual meeting with the Texas Railroad Commission. P. 74.

Importers are sticking to their guns on plans to bring in more foreign crude the first half of 1956. Reports to the Railroad Commission indicate the volume will be up 15.9 per cent. Canadian oil will raise the total. P. 83.

A price increase for crude now has its first organized support. TIPRO has moved to ask purchasing companies to boost prices by 20 per cent. P. 87.

Drilling

• **Pemex plans a 450-well drilling program** this year with the aid of 20 new rigs bought in this country. The program includes 72 wildcats. P. 89.

Russian technicians now are claiming a method of drilling without a bit. Special charges are fed into the hole. Upon leaving the drilling tool, they explode, deepening the hole. P. 89.

Heaviest string of 5-in. ever put in the ground has been run in the world's deepest hole. It weighed 26.06 lb. per foot. Richardson & Bass is preparing to perforate at 21,523-622 ft. in a bid to complete the well as the world's deepest producer. P. 68.

Exploration

• **Cuba's first commercial gas well** may be brought in soon. Cuban American Drilling & Exploration tested 5,000 M.c.f. daily from 2,700 ft. at its 1 Cristales 9 miles east of Jatibonico. P. 90.

Refining

• **The most complete picture of gasoline quality** ever assembled—that's what Ethyl Corp. has in its review just published. It shows that increased sensitivity due to higher levels of cat reforming hasn't affected road octanes as much as many believed. Another important fact: refiners should be able to raise Reid vapor pressure 1 to 1½ lb. without danger of vapor lock. P. 84.

High octanes and engines got a thorough going over at the W.P.R.A. meeting in San Antonio last week. Here's what members were told: There are several routes to higher octanes; 100-octane leaded gasoline is being produced in once-through Platforming; future improvements in the piston engine may crowd the gas turbine out of the picture. P. 78-80.

Production

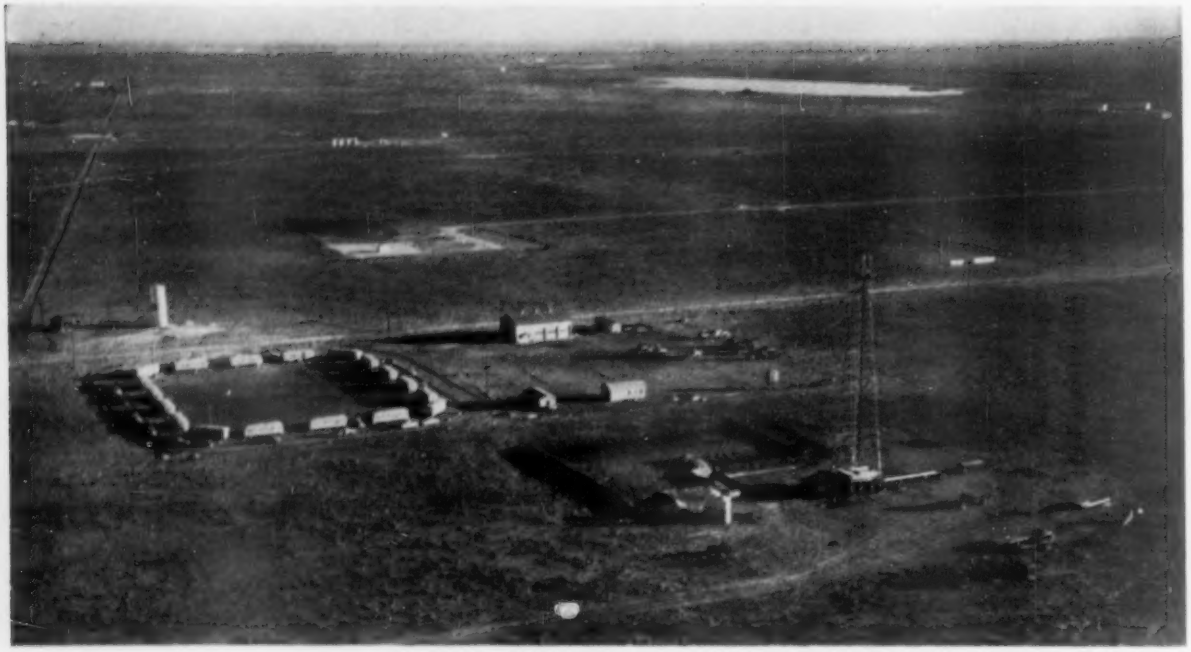
• **Belief is growing** in a minority group that the Permian basin is in its prime and that its future is down hill. For several years the big basin has been the most prolific and promising oil region in the nation. However, the really big strikes are getting fewer. P. 66.

Look for water-floods to produce the bulk of the nation's oil in the distant future. It now represents 5 per cent of total U. S. production and will jump to 25 per cent by 1980 and 60 per cent by 2035. P. 72.

Natural Gas

• **A bitter feud** is being waged in the FPC. In a split decision, the agency has set a policy of giving gas markets to coal if a project would result in "inferior" use of gas. Two commissioners claim FPC has no power to set up a national gas-conservation policy. P. 76.

The FPC is facing a storm on another issue. Natural-gas producers are seeking a showdown on prices. What started it was a Supreme Court ruling upholding sanctity of gas contracts. P. 73.



Has the Permian Basin Hit Its Peak?

Robert J. Enright

THERE are some who think this big area is in its prime and that the road ahead may lead down hill.

The big basin for several years has claimed the distinction of being the most prolific and most promising oil area in the country. It's going strong, and most exploration people see a big future for it.

But the last few years have seen the growth of a minority group of basin pessimists.

This pessimism has developed in spite of these facts:

. . . **The big basin area** (see map) produced roughly half a billion barrels of oil last year, an all-time record and a 50,000,000-bbl. gain over 1954.

. . . **Drilling** of both wildcat and development wells has continued high throughout the basin.

. . . **Total production** from basin fields is now running at about 1,800,000 bbl. daily. Some big-inch trunk lines completed only a few years ago already are operating at capacity.

These things make it look good for the basin. And most exploration people feel that greater things are yet to come. Yet there are a few who believe the area is reaching the top of its productive curve.

Why the gloomy outlook, then?

Big fields scarce . . . The pessimists say it's getting much harder to find large oil pools in the area. There have been no really big strikes in the last few years—pools between 50,000,000 and 100,000,000 bbl. or bigger.

Some West Texans think the Dora Roberts Ellenburger field found by Cities Service Oil Co. and Forest Oil Corp. in 1954 might reach 50,000,000 bbl. But there has been none since near this figure.

In 1955, they point out, no field was found which will exceed 25,000,000 bbl. of reserves. Only three of the basin's 1955 discoveries rank in the 10,000,000 to 25,000,000-bbl. class.

These three are reported as King Mountain field of Upton County, Armer field of Crane County, and Big Spring field of Howard County—all in West Texas.

The King Mountain strike, a multipay find by Humble D-1 Halff, looks like the biggest of the three. Its main producing formation is the Ellenburger.

Armer field is producing from the Tubb zone and the Wolf Camp.

The biggest surprise in the group is Big Spring—discovered by Phillips Petroleum Co. This was a Fusselman sand discovery at about 9,900 ft. Reserve estimates are believed based on areal extent of the field since sand section reportedly is only 6 ft. thick in places.

All other 1955 strikes are placed in the 1,000,000 to 10,000,000-bbl. category or below.

Not keeping up . . . This definitely means, basin pessimists say, that discoveries and additions to reserves in existing fields aren't replacing the 1,800,000 bbl. daily or so of oil which is being taken from the basin.

The just-issued American Petroleum Institute reserves study for 1955 shows Texas' reserves dropped 48,501,000 bbl. (*The Oil and Gas Journal, March 19, page 122*). New discoveries added only 164,181,000 bbl. of oil. Extensions in known fields and revisions of estimates added another 809,657,000 bbl.

Since the A.P.I. doesn't break its figures down by areas, there's no way of determining accurately the Permian basin reserve picture. Even the optimists for the future of the basin, however, concede that its reserves have been depleted during the last couple of years.

Taking the A.P.I. figures for Texas last year, one company executive looked at the situation this way: "The 164,181,000 bbl. of new discovery reserves added last year will be produced in a minimum of 15 years—or at an average of about 11,000,000 bbl. a year. That would figure out to approximately 30,000 bbl. a day.

"Figuring in reserves added by extensions and revisions of older fields would hike this to possibly 180,000 bbl. a day. Of course, you have to do the same thing with the oil found in the next 14 years to complete the picture 15 years from now . . . but even so, 30,000 bbl. a day in Texas isn't much oil—especially when you consider

the volume of oil being produced now in the basin alone."

Most geologists agree there have been no major discoveries so far this year. Only one, most think, may prove large enough to fit in the 10,000,000 to 25,000,000-bbl. class.

That is the Standard Oil Co. of Texas strike in the Sheffield Channel in eastern Pecos County. This one, the Sheffield-Ellenburger field, produces from 9,800 ft. and has created quite a stir.

The recent discovery of Pennsylvanian oil on the big Puckett structure in Pecos County also has attracted wide attention.

But the lack of new major reserves means, basin pessimists say, that the "cream" has been skimmed off. Oil that's left is getting much harder to find—and more costly. Companies gradually will start looking to more favorable areas, they believe, and basin production then will level off and begin to slump.

One major company already admits privately that it has shifted major attention away from the basin to other areas.

There's another side . . . The majority of the larger oil companies and most of the small ones, however, don't see it this way . . . especially the exploration people.

They point out a great many areas in the basin, some of them large, where big oil pools almost certainly await discovery. With oil-finding techniques constantly improving, a great many of these fields are going to be found.

As probably the best of the many prospective areas in the basin, most of them relatively untested, they list these (see map):

. . . **Delaware basin** (1). There is almost unanimous agreement that this basin and the adjoining **Val Verde basin** (2), will produce a great volume of oil in the future.

Humble Oil & Refining Co., Gulf Oil Corp., Hunt Oil Co. and some others got in early and appear to have a big early advantage over the rest of the field, especially in Pecos and Reeves counties. A representative of one of the basin's big producing companies laments the fact that his company isn't in this region.

Another exploration man foresees big things for the entire huge area from Pecos and Reeves counties southeast nearly all the way to San Antonio—all of it hardly touched by the drill from a geologist's standpoint. Sediments here also are much like those in presently more-prolific portions of the basin.

. . . **Carlsbad Shelf area** of Southeast New Mexico (3). There is considerable shallow production here but deep formations are promising and few deep tests have been drilled.

. . . **Northwestern part of Midland basin** (4), especially western Terry County and northeastern Gaines County.

. . . **Central basin platform** (5). Deep pays beginning with the Pennsylvanian and including Devonian and Ellenburger. Several fields have been found here in recent years but there should be many more.

. . . **Northwest basin** of Southeast New Mexico (6). Again, there are shallow fields here, but deep formations, principally the Ellenburger, are promising.

. . . **West edge of Eastern Shelf** (7).

. . . **West edge of Midland basin** (8).

. . . **North end of Midland basin** (9).

Generally, most exploration folk feel that tomorrow's new big production in the Permian basin will come from Pennsylvanian and deeper formations, including the Devonian and Ellenburger.

All admit it will be a terrific job to even replace that oil now being taken out of the basin, but most feel that the oil is still there to keep basin production climbing for quite some time. What's more, they think they'll find it.

How about pipelines? . . . The pipeline picture in the basin is spotty, with some of the large lines running full, others with a rather sorry load factor.

There now is about 1,919,400 bbl. of capacity for basin oil in main lines from the basin to refining centers. This figure includes all lines of 8-in. and larger. These lines at the first of February were handling 1,495,173 bbl. of oil daily . . . leaving 407,828 bbl. of space available.

Most pipeline people say this is too much space. But the figure is deceiving in that some lines are full. The problem lies in spreading this unused space over the basin producing area. Since this can't be accomplished, space available must be regarded as considerably less.

Generally, it appears that lines originating in the Midland area are running much closer to capacity than those originating in the McCamey area.

West Texas-Gulf Pipeline Co., which completed a 26-in. main line from Colorado City to the Gulf Coast early in 1953, averaged running 355,721 bbl. daily in January of its 381,000-bbl. daily capacity.

Rancho Pipe Line System ran an average of 222,903 bbl. daily of its 232,000-bbl. capacity through the 24-in. main it completed to the Houston area also early in 1953. Rancho is currently mapping a 25,000-bbl. daily expansion of capacity through construction of two more pump stations. Further, officials are said to feel that ca-

Pipeline Runs Out of the Permian Basin

	Pipeline capacity	Actual runs	Space
Atlantic:			
10-in. to Atreco	46,000	39,215	6,785
10-in. to Harbor Island	44,000	33,819	10,181
Basin:			
22-in. to Wichita Falls	350,000	224,825	125,175
West Texas-Gulf:			
26-in. Colorado to Ranger	381,000	*335,721	25,279
Humble:			
8-in. to Baytown (dual)	44,000	13,650	30,350
12-in. to Corpus Christi	63,000	24,847	38,153
18-in. to Satsuma	132,000	91,372	40,628
Magnolia:†			
8-in. to Beaumont	24,000		24,000
12-in. to Corsicana	70,000	‡128,689	36,311
12 to 16-in. to Corsicana	95,000		
Pasotex:			
8-in. to El Paso	55,000	60,726	—5,726
Phillips:			
10-in. to Sweeny	23,000	§21,937	1,063
12-in. to Borger	73,000	63,170	9,830
Rancho:			
24-in. to Houston	232,000	222,903	9,097
Service:			
16-in. to Drumright, Okla.	166,400	139,719	26,681
10-in. Cogdell to Bowie	33,000	31,921	1,079
Shell:			
10-in. to Cushing, Okla.	23,000		6,601
Tex-New Mex:			
12-in. to Houston	65,000	42,659	22,341
Total	1,919,400	1,495,173	407,828
To Port Arthur-Beaumont area	451,000	394,936	56,064
To Houston-Texas City area	456,000	392,521	63,479
To San Antonio-Corpus Christi	107,000	58,666	48,334

*Includes 246,143 bbl. daily from Midland's Mesa station to Colorado City. †Converted to L.P.G. service. Product shipments to start in next few weeks at probable rate of 12,000 bbl. daily. ‡Includes 3,370 bbl. daily natural gasoline. §Includes 3,328 bbl. daily natural gasoline.

pacity of this line may eventually have to be hiked on up to 360,000 bbl. daily.

Magnolia Pipe Line Co. likewise is being pressed for space. This company only last summer completed an expansion of its system from Midland to Corsicana hiking capacity for basin oil from 128,000 to 162,000 bbl. daily. Magnolia already is planning an additional expansion of this system's capacity — one which likely will be launched this year.

On the other hand, some other lines aren't faring so well. Basin Pipe Line System in January was running only about 224,825 bbl. daily of its 350,000-bbl. capacity to Wichita Falls, Tex.

And Humble Oil & Refining Co., with three lines out of West Texas and capacity of 239,000 bbl. daily, was running only about 129,869 bbl. daily.

Here then is well more than half of the unused capacity.

Adding in oil carried by smaller than 8-in. lines and that trucked to local refineries to that carried in the big lines, pipeline experts boost total oil taken from the basin to the 1,800,000-bbl. estimate mentioned.

When the West Texas-Gulf, Rancho, and Humble lines were completed in 1953—many felt that pipeline capacity out of the basin would be sufficient for many years if not forever.

If most of the exploration people are right, however, there may soon be need for more.

Navy Drilling Plan Hit

LOS ANGELES.—The Navy Department's proposal to drill for oil on St. Nicholas Island 60 miles offshore from Ventura County drew a blast last week from the Oil Producers Agency of California.

The agency called the plans "an unwarranted invasion of the private rights of citizens, an unjustifiable expenditure of taxpayers money, contrary to sound economics and sound public policy." A resolution to that effect was forwarded to President Eisenhower and members of Congress.

The Navy has asked Congress for $529,000 to explore the island. A favorable report on oil possibilities there was made by the U. S. Geological Survey *(The Oil and Gas Journal, March 19, page 132).*

The Western Oil and Gas Association also opposed the Navy plan on the ground that the island is public land and that development should be done as provided by law.

R.&B. Runs Casing

● Record-deep hole gets string of 26-lb. per foot 5-in.—heaviest ever run

PORT SULPHUR, La.—Richardson & Bass has run the heaviest string of 5-in. pipe ever put in the ground.

The casing was 26.06 lb. per foot P-110 5-in. o.d. plain-end pipe. Last week the operator was nippling up its record-depth 1-L Humble-L.L.&E. State Lease 2414 and preparing to pick up tubing before perforating the well for completion.

The record-breaking casing joins a 5-in. liner already in place from 18,702-21,809 ft. Because there is only a limited clearance between the 5-in. and 7-in. intermediate string, no cement was placed around the 5-in. However, the specially built Brown patch tool not only seals the two strings together, but also seals them against the 7-in. with four lead seals and two Hycar seals.

After picking up production tubing, Richardson & Bass expects to circulate the hole, pull out, and perforate it for production. The interval to be shot, from 21,523-21,622 ft., is 4,000 ft. deeper than any formation presently producing. Oil was circulated from the hole after the well kicked some 3 months back. And the operator is optimistic that the zone to be perforated is the same one from which that oil came.

After perforating, production tubing will be run and hung out of the christmas tree without a packer. Available grade of tubing may not be strong enough to hold the first pressure that may exist in the prospective zone. Richardson & Bass is depending upon the heavy 5-in. to hold the well pressure.

If the zone has a normal pressure gradient, bottom-hole pressure will exceed 10,000 psi. If it has an abnormal pressure gradient, as indicated by the fact the well could flow when full of 18-lb. mud, bottom-hole pressure of 20,000 psi. could easily be present. That would exceed any yet encountered.

Richardson & Bass reports no special trouble in running the 5-in. The hole now contains a new calcium-surfactant mud developed by Magnolia Petroleum Co. for high temperature. Lowering casing through this mud was easy. The operator expects no trouble in making the many runs that will be necessary with the perforating gun to shoot the entire 99-ft. section.

The wildcat, located 35 miles southeast of New Orleans in the Mississippi delta marshes, was bottomed at 22,570 ft. for the deepest hole ever drilled.

Alaska Perks Up

● Phillips spuds in third test as other explorers plan their summer work

ANCHORAGE.—Oil activity in Alaska is showing signs of coming to life after nearly shutting down for the winter.

Phillips Petroleum Co. has spudded its third test in the territory. Colorado Oil & Gas Corp., Denver, is seeking entry into Alaska on a 35,200-acre block. Several other companies are making plans to carry out seismic operations this summer.

The Phillips well is the 2 Sullivan Unit just north of Icy Bay. It was spudded 1,200 ft. south of 1 Sullivan which was abandoned as a dry hole in December 1955, at a total depth of 10,015 ft. *(The Oil and Gas Journal, February 13, page 91).*

Crews have set 13⅜-in. casing in the new well and cemented it to below 1,500 ft. The test is scheduled for 10,000 ft.

This will be Phillips' third attempt to find commercial oil on its million-acre tract.

The first hole drilled was a stratigraphic test 7 miles from the 1 Sullivan. It was abandoned as dry.

However, a recent Phillips move was interpreted by oil observers here as a sign that the company still likes its chances in Alaska. Phillips optioned 50,000 acres in the Kenai Peninsula. Other major firms also hold sizable blocks of acreage on the Peninsula.

Other activity . . . The Colorado firm has filed application for 16 oil and gas leases comprising 35,200 acres in the Yakutat and Icy Bay areas.

Colorado Oil also is completing a deal with Yakutat Development Co. to develop its block of more than a million and a quarter acres.

If approved by Interior Secretary Douglas McKay, the development contract will permit Colorado Oil to do seismic and geologic mapping between Dry Bay and Yakutat, on the Gulf of Alaska, beginning early in May.

Four oil companies expect to have geologic crews in Alaska this summer. They are Standard Oil Co. of California, Shell Oil Co., Richfield Oil Corp., and General Petroleum Corp.

In addition, Havenstrite Oil Co., Los Angeles, intends to deepen its second hole on the Iniskin Peninsula on the west side of Cook Inlet. It was suspended last winter at 9,745 ft. Three local operators also will be drilling in the area surrounding Anchorage.

watching WASHINGTON

. . . with Bertram F. Linz

Do mineral resources deserve cabinet spokesman? . . .

A FEDERAL Department of Mineral Resources, under a secertary with cabinet rank, might be a good thing.

At any rate, Sens. James E. Murray and Mike Mansfield of Montana think so. They feel it is time the oil, coal, and mineral industries were recognized for what they are—the source of basic raw materials without which we cannot survive—and have sponsored a bill to bring this about.

Murray, who is chairman of the interior affairs committee, has long been interested in oil and minerals, both of which are produced, of course, in Montana. He says he has no quarrel with the Interior Department. But if mineral policies had been put in the hands of an agency exclusively devoted to them a generation ago, with a cabinet member to speak for and defend them, "we would not have been through such cycles of lean and fat, pressures to expand followed by oversupply, and depression due to excessive imports," he asserts.

When our Government was set up there wasn't any real minerals industry. Like many other things that developed over the years, minerals and later oil were tossed into departments where they might fit, even if they didn't. It's time oil and minerals were taken out of the mixture of Indians, electric power, irrigation, and public lands that is the Interior Department, Murray thinks.

There isn't any rule against setting up new departments. The Commerce Department was taken out of Labor in 1913. Health, Education, and Welfare was set up in 1953. The War and Navy departments were made part of a new Defense Department in 1947. There was no Interior Department until 1849 and agriculture wasn't given a department until 1862.

Flemming doesn't want standby controls . . .

HERE'S a case where a government agency doesn't want more power. Mobilization Director Arthur S. Flemming has told Congress he doesn't want standby authority to control prices, wages, and materials in the event of an emergency.

The idea of standby controls which could be applied by the President if and when needed has been knocking around for several years. Flemming has never gone for it, preferring instead to write and file bills which Congress could pass in a matter of hours if an emergency arose.

The argument behind the plan for standby controls is they would prevent another round of delay in an emergency such as occurred in World War II and again in the Korean action. It took months to get the machinery rolling, while prices and wages rose and vital materials were disssipated.

There's a good argument against the plan, too. Some President in a political jam could dream up an emergency and regiment the economy.

Trust buster leaves Justice Department . . .

RESIGNATION of Asst. Atty. Gen. Stanley N. Barnes to become a judge in the Ninth Circuit Court of Appeals will leave one of the most important posts in the Justice Department open.

Barnes, head of the antitrust division since 1953, has been a vigorous "trust buster." He has been firmly supported by Atty. Gen. Herbert Brownell, Jr., and presumably the President. Only a few cases were brought against oil interests, however, and he leaves to his successor the New York "cartel" suit which he, in turn, inherited.

The change in leadership of the antitrust division is not expected to lead to any modification of policy. Barnes' successor, not yet announced, most likely also will be committed to the suppression of monopoly, a field in which Eisenhower administration has been more active than expected.

WANTED: BUYERS FOR SOUR CRUDE in West Texas. P. W. Pitzer, Jr., president of West Central Texas Oil and Gas Association, directs the distress plea toward top executives and crude buyers of major companies at the Texas allowable hearing.

Producers Plead for Aid

Companies largely turn deaf ear on producers' efforts to sell West Texas sour crude; April allowable in Texas cut

AUSTIN.—West Texas independents, stuck with upwards of 10,000 bbl. daily of unwanted sour crude, have made some headway toward finding a market. But most of it is still going begging.

Producer representatives met here before and after the state-wide crude-oil allowable hearing with crude buyers of the major companies in an attempt to get relief.

At the hearing itself, the hardship was brought to the attention of the Texas Railroad Commission by P. W. Pitzer, Jr., second-term president of the West Central Texas Oil and Gas Association.

Pitzer told the commission he felt the pinched producers in the Scurry, Howard, Mitchell, and Glasscock counties could see the trouble through if they could sell half a million barrels of oil during the next 90 days. Production from the area, which has skyrocketed in recent months due to fracturing of many new and old wells, probably will begin to slacken during this period, Pitzer told the commission.

Speaking for the producers, he asked each of 13 crude-buying companies to take 50,000 bbl. each in the 3 months. This figures out to 560 bbl. each per calendar day.

Three of the buyers—Humble Oil & Refining Co., The Texas Co., and Magnolia Petroleum Co.—said they could take this amount, provided the oil could be delivered to them.

Clint Small, of Coffield & Guthrie, which gathers oil in the area, said his firm could connect the unwanted oil within 3 days to pipelines owned by Magnolia Pipe Line Co. and Shell Oil Co.

Small said there had been no change in the situation in the past month. He called it "still desperate"—with lease and gathering-system storage full and the sour-crude fields cut to 63 per cent of their allowable on the average by pipeline proration.

The offers from Humble, Texaco, and Magnolia still leave the producers with 8,320 bbl. daily of distress crude on their hands.

William J. Murray, Jr., chairman of the Railroad Commission, expressed concern over the situation. The commission, he said, can't tell purchasers they must buy, but is always concerned whenever oil production and runs aren't ratable.

No further response . . . At midweek, no other purchasers had come forward to take more of the sour oil.

Leaders of the producer's group said letters would be sent to companies again urging them to take the distress crude.

From Breckenridge, Pitzer told the Journal that representatives of producers and gatherers were conferring with Shell and Magnolia in regard to putting distress oil into their lines for delivery to other buyers.

Pitzer said that the oil, though quite sour, "compares favorably to that imported from the Middle East."

A demand problem . . . The West Texas fields with distress crude include Diamond M Clearfork and San Andres; Sharon Ridge Clearfork, 1,700 ft., 2,400 ft., and 2,900 ft.; Coleman Ranch and Coleman Ranch North; Iatan-East Howard and Iatan North; Westbrook; Howard-Glasscock; Snyder; and Varel fields *(The Oil and Gas Journal, March 12, page 80)*.

Hardest hit by pipeline proration appear to be Westbrook and Varel. The latter is a relatively new field. Most of the others are older fields rejuvenated by fracturing. All produce from shallow pays, primarily the Clearfork and San Andres zones.

Many of the wells are said to be marginal, and these, producers contend, may have to be abandoned if pipeline proration continues. A few water floods which had been planned for fields in the area have been delayed.

The fields are in something of an "island" marketing area where the bulk of the production goes to local refineries operated by Cosden Petroleum Corp. at Big Spring, Tex., and Col-Tex Refining Co. at Colorado City. These markets have been swamped by the rising flood of crude. No large companies are eager to rush to the rescue with a pipeline into the area because, their buyers say, every line passing within reasonable distance already is overloaded with sour oil.

Allowable cut . . . Finally getting around to the routine business at hand March 16, the Railroad Commission clipped off recent record-setting allowables to 3,356,857 bbl. daily for April. That's a cut of 50,969 bbl. daily from March 3 and of 9,381 bbl. daily from the initial figure for March.

ALLOWABLE FOR APRIL

District—	April	Change from March 3
1—Southwest	68,544	— 299
2—Gulf Coast	159,450	— 3,722
3—Gulf Coast	474,064	— 7,846
4—Southwest	263,847	— 5,554
5—East Central	57,521	— 940
6—Outside E. Texas field	136,558	— 3,139
6—E. Texas field	219,050	— 6,462
7-B—N. Cent. Texas	204,026	— 3,226
7-C—W. Cent. Texas	215,572	— 1,024
8—West Texas	1,119,547	—17,830
9—North Texas	299,111	— 2,021
10—Panhandle	139,567	1,094
Total	3,356,857	—50,969

Drillers Get New Tool

Numerical tables permit faster drilling in crooked-hole areas because they quickly relate all engineering factors

FORT WORTH.—Simple tools which drillers can apply easily to drill faster in crooked-hole areas and still stay within hole-deviation limits were unveiled here last week.

The tools are tables which relate hole size and inclination, drill-collar size, formation dip, and weight on bit.

They are the work of the study committee on straight-hole drilling of the southwestern district of the American Petroleum Institute's Division of Production. The study committee, headed by H. M. Rollins, Drilco Oil Tools, Inc., Midland, Tex., completed 4 years of work on the crooked-hole problem with a report last week to its parent drilling-practice committee at the southwestern district's spring meeting here.

The numerical tables were adapted from graphical data developed earlier by H. B. Woods, Hughes Tool Co., Houston, and Arthur Lubinski, Stanolind Oil & Gas Co., Tulsa. The numerical system was developed, Rollins said, when it was determined that crews actually operating the rigs weren't using the graphs because of a reluctance to use graphical solutions. And such personnel, he said, were the ones most needing the information.

Cuts deviation . . . Use of the tables is no cure-all for crooked-hole areas.

The committee warns, in fact, that little can be done with conventional drilling practices to keep a hole straight in severe crooked-hole conditions. Deviation, however, can be held down to some extent and drilling speed increased.

Rollins and his committee prepared three sets of tables for formation dips of 7½°, 15°, and 30°. For each dip condition, tables are included for hole inclinations of 2°, 3°, 4°, 6° and where applicable, 10°, 15°, and 20°.

These values were prepared for all practical drill-collar sizes by ½-in. increments for 6¼-in., 6¾-in., 7⅞-in., 8¾-in., 9-in., 9⅞-in., 10⅝-in., and 12¼-in. hole sizes.

Bit weights vary from a very small value up to the maximum value which the committee could foresee for several years. The tables likewise indicate best position for stabilizers.

The tables hold true, Rollins said, only when there is an equilibrium condition—that is, where the hole angle remains constant for 60 to 100 ft. at a constant weight on the bit.

"Pendulum" is basis . . . The relationships in the tables are based on the Woods-Lubinski discovery of the pendulum action of the drill string in an inclined hole.

In an inclined hole, the portion of the drill-collar string from the bit to the first point of contact with the wall of the hole is supported only by the bit. This portion tends to swing back to vertical.

This so-called pendulum action works against the normal inclination of the bit to deflect from a straight course in the direction of the dip of the "crooked-hole" formation. Greater weight on the bit increases this inclination, lesser weight cuts it.

When these two forces counterbalance each other, the hole deepens at a steady angle.

The pendulum effect depends on the hole angle, the length from the bit to the first point of contact, and on the weight per foot of the drill stem in this section of hole.

The length of the cleared section of drill stem varies with the hole inclination, the stiffness of the drill collar, the clearance between the drill collar and the wall of the hole, and the axial load on the drill-stem assembly.

Large drill collars produce a greater pendulum effect normally than small collars because they are heavier and stiffer (thus contacting the wall of the hole at a higher point). Stabilizers can be used to increase the length between bit and wall contact. The new tables also indicate where stabilizers should be located under the various sets of conditions.

Small drill collars without stabilizers, the committee found, are very poor pendulums. Medium-sized collars without stabilizer or small drill collars with stabilizer are poor; large collars without stabilizer or medium-sized collars with stabilizer are fair; and large collars with stabilizer are excellent pendulums.

Data in the tables do not apply when a reamer is used near the bit, since this voids any pendulum action.

Good bottom-hole assemblies put together in such a manner are essential to achieving good penetration rates in crooked-hole areas, Rollins said.

For thin zones . . . Only exception to this rule is where the crooked-hole zone is relatively thin.

In such a case, a technique involving use of the "stiffest" bottom-hole assembly possible has been successful. Such a still assembly can be achieved by placing a reamer immediately above the bit, then a large-diameter drill collar and a stabilizer or string reamer at the top of the drill collar.

This minimizes the pendulum effect and permits penetration into the trouble zone with a gradual increase in deviation.

It is often possible to drill through such a thin zone this way before reaching maximum allowable deviation, but if prolonged the buildup of hole angle would be extreme.

Field applications of the Woods-Lubinski data have resulted in great savings in drilling time in both North and West Texas, Rollins said.

Further application could cut drilling costs and time much further.

Merger Under Study

Rival oil-chemical unions hold conferences on plan

KANSAS CITY.—The possibility of merging is being studied by a special committee representing the Oil, Chemical and Atomic Workers International Union and the International Chemical Workers Union.

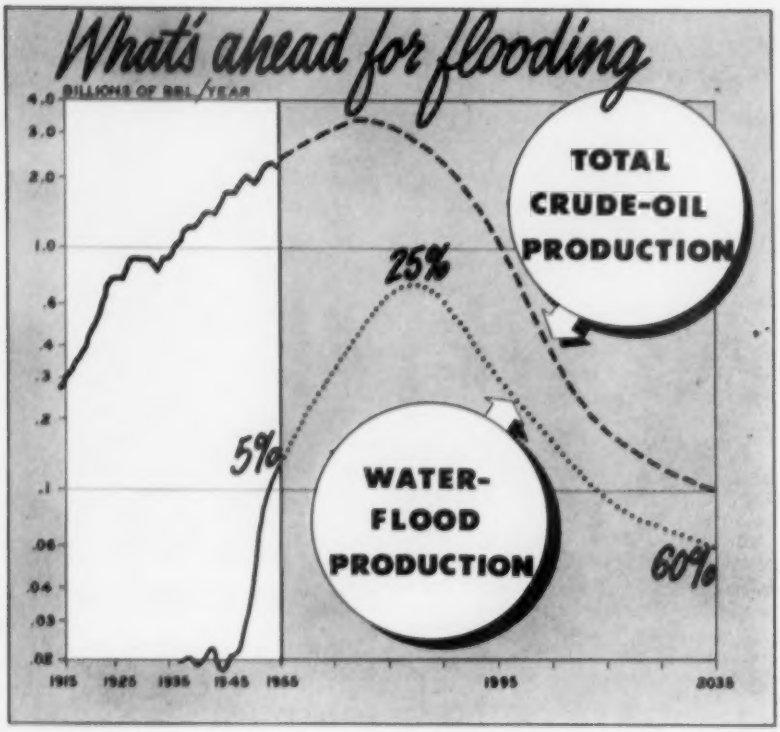
The 200,000-member O. C. A. W. would gain 80,000 chemical workers through the proposed affiliation. O.C.A.W. is a former C.I.O. affiliate, while I.C.W.U. formerly was aligned with the A.F.L.

The special committee was named by delegates from each union. It held a meeting here March 17-18 to discuss the merger proposal. The O.C.A.W. delegation was headed by O. A. (Jack) Knight, president. First vice president Joseph J. Donovon was leader of the I.C.W.U. contingent.

Industry observers saw the proposal as another step in Knight's announced aim of forming a million-member organization embracing all unions in the oil, chemical and atomic fields.

The delegates here explored the many differences in organization structure of the two unions. The special committee then was appointed to examine more closely the differences and report back to merger committees already existing in each union. Any final steps must await reports of the merger committees and a decision of basic policy by the unions' conventions.

Many chemical workers are employed by companies in which O.C.A.W. also has members. O.C.A.W. is counting on cooperation between these units to pave the way for merger of the two unions.



Water-Flood Role Grows

It's now 5 per cent of total U. S. production but look for recovery to reach 60 per cent early in next century

WICHITA FALLS.—Water-flood projects eventually will produce the bulk of the nation's oil.

Only about 5 per cent of domestic crude comes from water floods now. But this is destined to jump to 25 per cent by 1980 and to 60 per cent by 2035.

That is the startling trend revealed here last week by Albert E. Sweeney, Jr., director of technical services for the Interstate Oil Compact Commission. He addressed the twenty-sixth annual meeting of the North Texas Oil and Gas Association.

Sweeney declared that the annual production from water floods has increased in the last 4 years from 80 million barrels to 130 million. This represents an increase from about 2.8 per cent of the total United States production in 1950 to more than 5 per cent during 1955.

He termed "this increase little short of phenomenal" but said it is small by comparison with what is coming. Sweeney estimated that in 1980 total oil production will reach 3 billion barrels annually with 750 million barrels or one-fourth attributable to water floods. In 2035 total production will have dropped to 100 million barrels with 60 million of this from water floods.

What's ahead . . . Sweeney gave this summary of water-flood prospects:

. . . Past production: From 1915 to 1954 total oil production has been 50 billion barrels. Of this 1.2 billion barrels has come from water floods.

. . . Proven reserves: In 1955 these were estimated at 30 billion barrels which should last until 1965 at the present rate of consumption without additions. Of this, 10.3 billion barrels are water-flood production reserves estimated to last until 1977.

. . . Future discoveries: These are estimated at 85 billion barrels with 21 billion coming from water floods.

By Sweeney's figures, oil production through 2035 should total 165 billion barrels with the total water-flood production at 32½ billion barrels. Peak oil production likely will come about 1970, he estimated, and peak water-flood production 10 years later.

Where is oil? . . . Sweeney declared five states will provide most of the stepped-up water-flood production.

Texas, Louisiana, California, Illinois, and Oklahoma will produce most of the increase with sizable recovery from nearly every other oil-producing state in the nation, he said. These states in the past have been the major producers from water floods. And their prospects are best for continued big production.

Water flooding had its beginning in the 1920's in the oil fields of Pennsylvania. Oklahoma was the first state west of the Appalachians to use the oil-recovery technique. The first project started in 1932-33. Production since has increased until it represented nearly 14 per cent of the state's total output.

Kansas turned to water flooding in 1935, and now 12½ per cent of its total production is obtained by this secondary-recovery method. About 30 per cent of Illinois' total production also is from water flooding.

Texas has stepped up its water-flood production from 4 million barrels in 1950 to almost 30 million in 1955. However, this now represents only 3 per cent of the total Texas production.

But the water-flood trend in all these states and other oil-producing areas will be on the rise.

Crisis ahead . . . Sweeney is the second speaker in recent weeks to predict the United States oil production will reach a peak within the next few years.

M. King Hubbert, chief geological consultant for Shell Development Co., Houston, told the A.P.I. Division of Production in San Antonio earlier this month that domestic production will level off and begin to drop within 10 years. Hubbert said the deficit will be filled by imports and later by nuclear energy.

New Gas Plant for Wyoming

CASPER, Wyo. — Three major oil companies plan to build a $200,000 low temperature, natural-gas recovery plant at Lance Creek, in Niobrara County, Wyoming.

Participating in the project are Ohio Oil Co., Continental Oil Co., and Argo Oil Corp. of Denver. The plant will be operated by Ohio.

The 5,000,000 cu. ft. plant will replace one built at Lance Creek by Continental in 1938 and now considered obsolete. A contract will be let soon by Ohio. Construction will begin on the site of the old unit as soon as it is dismantled. Completion is scheduled in 6 months.

The plant will utilize the latest refrigeration processes in recovering gas.

A Continental spokesman said although the plant is designed for 5,000,000 cu. ft., it will process 4,000,000 cu. ft. initially. Production will include 5,200 gal. of gasoline, 5,200 gal. of propane and 10,300 gal. of butane.

Gas-Price Test Forced

Producers are seeking showdown with FPC after Supreme Court in key decision upholds sanctity of gas contracts

WASHINGTON.—A Supreme Court decision upholding the sanctity of gas contracts is giving Federal Power Commission officials a big headache. The decision may have a far-reaching effect on federal regulations of natural-gas producers.

In a unanimous opinion the court ruled that United Gas Pipe Line Co. could not in effect kill a sales contract with a customer by increasing the price above the figure specified in the contract.

That decision was on February 27, and ever since then attorneys for gas producers have been asking: Does this work in reverse? Does this mean that a pipeline cannot pay a producer less than his contract price? Is the FPC required to let a price escalation go into effect as called for in an existing contract?

Test case coming . . . Last week producers' attorneys put these questions before the FPC in what may become a big test case.

This case involves E. J. Hudson, Maracaibo Exploration Co., and other producers supplying gas to Transcontinental Pipeline Corp. Increases in field prices called for under escalation provisions in the contracts had been suspended by FPC, and investigation was in progress.

Now these producers have filed a motion to dismiss the investigation and permit the higher prices to go into effect. Their attorneys argue that the higher price is not a "new" price nor a "change" in the contract, but is called for in an old contract, voluntarily made by the pipeline, and previously reviewed and accepted by FPC.

The United case, it is contended, restricts FPC's authority to passing on new or revised contracts only, and prohibits it from interfering with the operation of contracts once they have gone into effect. By preserving the integrity of contracts, the lawyers argue, the United decision permits the stability of supply arrangements which all agree is essential to the health of the natural-gas industry.

Indirect application . . . The Supreme Court's decision did not touch on FPC authority directly, but the principle it laid down could have far-reaching effects.

The contract involved there covered deliveries by United to Mobile Gas Service Co. for resale to an industrial customer. Under the present law, FPC has no power to suspend rates for industrial sales, so it took no action when United filed a higher rate. But Mobile Gas took the case to court and eventually won a Supreme Court ruling that the Natural Gas Act does not empower pipelines to change their contracts "unilaterally."

Since then, many other gas distributors have begun preparing claims for refunds against transmission companies that have raised their rates for industrial gas in the same way that United attempted to do. Such claims may run into many millions of dollars. Pacific Gas & Electric Co., for instance, has already filed a claim for $20,000,000 against its pipeline supplier.

Gas Inquiry Called

Board hears Kansas part of Hugoton being drained

WICHITA, Kans.—The Kansas Corporation Commission will hold a hearing here March 30 to investigate a charge that Oklahoma and Texas wells are draining natural gas from the Kansas portion of Hugoton field.

The charge was made by Oliver Brown, president of the Southwest Kansas Royalty Owners Association.

In ordering the hearing, the commission said purchasers of gas from the Kansas portion of the field must show cause why they should not be required to take ratably from the various wells in order to prevent discrimination, drainage, and waste.

These purchasers are Colorado Interstate Gas Co., Cities Service Gas Co., Hugoton Production Co., Kansas-Colorado Utilities, Inc., Kansas-Nebraska Natural Gas Co., Panhandle Eastern Pipe Line Co., Northern Natural Gas Co., United Carbon Co., Quinoue Oil & Gas Producing Co., and Shallow Water Refining Co.

Brown also claimed that Kansas is subject to discrimination in marketing gas. He said Kansas is forced by statute to sell Hugonton gas at a minimum wellhead rate of 11 cents per 1,000 cu. ft. Oklahoma's rate is slightly under 10 cents and Texas' 5-7 cents. Under this setup, Brown added, Oklahoma and Texas are selling much more gas than Kansas.

Industry BRIEFS

AUSTIN. — The Texas Railroad Commission has adopted a new rule to guard against pollution of fresh-water supplies due to petroleum-industry exploratory drilling. The commission defined "exploratory well' as any well drilled for geological information to a depth greater than existing fresh-water strata. Included are "slim-hole" and "core-hole" tests.

LOS ANGELES.—Oceanic Drilling & Exploration Co. has been organized as a limited partnership with capitalization of $925,000 by Oceanic Oil Co. and J. Barth & Co. Funds of the new partnership will be used to explore in the Taft-Fellows area of Kern County. A program of 15 to 20 wildcat wells is planned in the next 2 years.

DALLAS.—Petroleum Reserves, Inc., Dallas, has paid $750,000 for 26 producing wells on 7,387 gross lease acres in North and East Texas. The properties formerly were owned by David C. Bintliff, Houston investment banker. George C. McGhee, Petroleum Reserves executive, said the East Texas properties are primarily in Woodlawn field of Harrison and Marion counties. Those in North Texas are in Clay County.

TULSA.—Carter Oil Co. will take bids April 1 for a two-story wing to its research laboratory here. The addition will provide facilities for 100 employes and add 25,000 sq. ft. of laboratory and office space.

LOS ANGELES. — Residual fuel supplies on the West Coast reached their lowest point since World War II in February. Stocks were 10,794,000 bbl. on February 29 compared with 25,119,000 bbl. at the end of February 1955. The daily February deficit was 33,000 bbl.

The withdrawals of crude, distillates, and residual fuel, however, were more than offset by increasing gasoline stocks, which sent total West Coast petroleum stocks to the highest point since October 1954. Gasoline stocks increased 4,837,000 bbl. over February last year.

SANTA FE.—New Mexico's oil allowable for April has been fixed at 287,410 bbl. per day, a decrease of 152 bbl. per day from March. The New Mexico Oil Conservation Commission allocated 273,685 bbl. daily for southeast New Mexico, a state-wide supplemental allowable of 10,000 bbl. daily, and 3,725 bbl. daily for northwest New Mexico.

SOME OF THE BIGGEST names in oil appeared before the Railroad Commission to tell . . .

Where the Industry Is Going in '56

AUSTIN.—Look for a 4.4 per cent increase in domestic demand this year.

That's the composite prediction of the best economic brains of the entire slate of major United States oil companies. It was laid before the Texas Railroad Commission by top executives of these firms March 16 along with other estimates on planned volumes of imports and desirable levels of crude and product stocks for the year.

The Austin assembly, timed to coincide with the regular monthly statewide crude-oil allowable hearing (see page 70), featured one of the largest groups of oil's top brass ever assembled in one small room.

Only the Standard Oil Co. (N. J.) delegation, stranded in the Carolinas by bad flying weather, was missing.

The Railroad Commission in the past few years has annually solicited information from the major oil companies to help guide it in judging demand and fixing allowables. Up to now, however, the data has been given via questionnaires.

This time the commission asked the company executives to appear in person to testify. It was widely anticipated that they would be subjected to searching crossexamination by commission members, especially in regard to imports. The testimony, however, was delivered quickly and with few interruptions by questions from the commissioners.

Demand estimates ranged from a low of 3.5 per cent by Shell Oil Co. to a top of 5 per cent by Gulf Oil Corp., Eastern States Petroleum Corp., and Southwestern Oil & Refining Co.

Jersey Standard, which telephoned in its data, estimated 4.5 to 5 per cent.

How about stocks? . . . Generally, the companies feel that present stocks of

What's Par for Crude Oil and Product Stocks?

(Millions of barrels)

Company—	Ideal stock levels, April 1					Ideal stock levels, November 1				
	Crude	Gasoline	Kerosine	Distillate	Residual	Crude	Gasoline	Kerosine	Distillate	Residual
Atlantic Refining Co.	269	175	18	70	42	272	140	37	155	54
Standard Oil Co. of California	265	175	20	65	40	270	140	35	145	45
Cities Service Co.	255	170	18	60	40	265	140	36.5	150	55
Continental Oil Co.	255-60	175-80	19-20	60-65	38-40	255-60	155-60	35-37	145-50	45-48
Eastern States Petroleum Co.	260	175	22	75	40	260	135	45	130	60
Gulf Oil Corp.	255	160	18	55	40	255	125	35	135	50
Humble Oil & Refining Co.	250-60	180-90	17-19	60-64	34-38	250-60	145-55	35-37	150-60	42-47
Magnolia Petroleum Co.	255-60	170	15	57	38	260-65	134	35	150	48
Phillips Petroleum Co.	255-60	180-85	16-17	64-66	36-38	255-60	145-50	36-37	150-55	45-50
Shell Oil Co.	250	180	15	65	40	255	145	38	150	50
Sinclair Oil Corp.	270	176-80	18-20	68-70	36-38	275	144-48	36-38	152-56	48-50
Socony Mobil Oil Co., Inc.	262	170	14-17	57	38.3	275	134	35.1	150	47.7
Sohio Petroleum Co.	265-70	170-75	18-20	60-65	40-45	270-75	135-40	35-38	145-50	50-55
Southwestern Oil & Refining Co.	265	185	20	75	40	270	155	37	150	51
Standard Oil Co. (Ind.)	260	185	20	63	40	260	150	35	155	52
Standard Oil Co. (N. J.)	260-70	185-90	17	60-65	38-40	260-70	145-50	35-37	155-60	49-52
Sun Oil Co.	265	180	18	60	40	275	150	35	140	50
The Texas Co.	260	170-75	16-17	58-60	38-40	260	130	35-36	138-42	50-53
Tide Water Associated Oil Co.	255-65	170-80	17-19	57-63	37-42	265-75	135-45	33-37	140-50	47-52

A. L. NICKERSON
. . . "Domestic demand will rise 4 to 5 per cent this year . . . 3 to 4 . . . through 1960."

FRANK O. PRIOR
. . . "Stocks of crude should be held steady at 260,000,000 bbl. in April and November."

R. G. FOLLIS
. . . "Total stocks are about right—crude slightly low, gasoline slightly high."

crude and products are about right. Only fly in the ointment appears to be gasoline, where nearly all companies termed stocks considerable excessive.

The desirable level of crude stocks for April, as fixed by the various companies, ranged from a low of 250,000,000 bbl. to a high of 270,000,000 bbl. The average was 260,670,000 bbl. These stock figures—and all others in the reports—excluded pipeline fill and that below tank outlets. The crude-stocks figure compared with total crude stocks of 255,993,000 bbl. March 10.

The composite "ample" crude-stock level for November 1 was higher at 264,500,000 bbl. Individual estimates ranged from 250,000,000 to 275,000,000 bbl.

One of the interesting figures in the November group was submitted by A. L. Nickerson, president of Socony Mobil Oil Co., Inc. Nickerson reported November crude stocks should be 275,000,000 bbl.

Nickerson said he thought it would be wise to let crude stocks accumulate through the summer to possibly 275,000,000 bbl. and then liquidate them during the winter.

Gasoline figures . . . Compositely, "ample" gasoline stocks for April 1 were fixed at 177,000,000 bbl.—with individual figures ranging from 160,000,000 to 190,000,000 bbl. The average for November 1 was 143,000,000 bbl., stretching from a low of 125,000,000 to a high of 160,000,000 bbl.

Total gasoline stocks currently are far above the 177,000,000-bbl. level indicated by the companies as desirable. Gasoline stocks totaled 195,669,000 bbl. March 9.

Noting this difference, Commissioner E. O. Thompson queried J. L. Latimer, president of Magnolia Petroleum Co. as to why this had occurred. Latimer said refineries were running too much crude. He added that refining and production departments, though not supposed to, sometimes appear to be working in different cells.

The companies indicated they intend to import an average of 889,287 bbl. daily of crude oil throughout 1956 and 353,400 bbl. of products daily, excluding bonded fuel. This compares with actual reported imports during February of 785,256 bbl. of crude and 414,102 bbl. of products a day, not including bonded fuel oil amounting to 62,161 bbl. daily.

What Each Company Has on Hand—and What It Needs

Company—	Actual days' supply					Minimum needs in days' supply				
	Crude	Gasoline	Kerosine	Distillate	Residual	Crude	Gasoline	Kerosine	Distillate	Residual
Atlantic Refining Co.	32	28	50	33	23	31	29	48	25	23
Standard Oil Co. of California	13	38	23	42	32	11	24	15	26	20
Cities Service Co.	14	33	18	22	7	18 to 22 days				
Continental Oil Co.	18	41	15	17	13	10	others varying			
Eastern States Petroleum Co.	12	30	0	10-12	10-12	10 to 12 days				
Gulf Oil Corp.	30	41	42	29	23	18				
Humble Oil & Refining Co.	10	43	26	29	25	14.5	21	15	20	25
Magnolia Petroleum Co.	21	9	4	3	25	20	10	7	7	7
Phillips Petroleum Co.	12	51.6	47.7	24.7	13.2	9	27.9	28.2	15.6	4.6
Shell Oil Co.	24	50	42	28	22	20	47	42	36	26
Sinclair Oil Corp.	10	29	37	21	21	10				
Socony Mobil Oil Co., Inc.	24	37	63	47	30	24	33	66	50	22
Sohio Petroleum Co.	10	15	15	3	18	10-10	16-5	21-110	7-30	*18-33
Southwestern Oil & Refining Co.	4	48	13	13	20	6				
Standard Oil Co. (Ind.)	24	52	37	30	18	21	49	37	29	16
Standard Oil Co. (N. J.)	6.8	32.5	34.7	22	14	8	24.9	17.1	14.9	11.7
Sun Oil Co.	24	21.7	42.4	16.1	19.8	29				
The Texas Co.	10	21	19	19	13	10	19	19	19	15
Tide Water Associated Oil Co.	35	41	28	46	30	30	30 to 40 days			

*Sohio gave two sets of ideal stocks for April 1 and November 1. They are given in the two columns.

FPC's Gas-Saving Decision Stirs Feud

- **Split decision sets policy of giving gas markets to coal if a project would result in "inferior" use of gas**

- **Digby, Stueck dissent strongly, saying FPC has no power to establish a national gas policy or conserve gas**

WASHINGTON.—A bitter fight over conservation of natural gas apparently has split the Federal Power Commission. The issue appears headed for the courts.

Two of the FPC's five members warn outcome of the quarrel could seriously affect oil operators producing casinghead gas and run the federal agency into conflict with state conservation bodies.

The dissension within the FPC came to light last week. It stemmed from a decision upholding an examiner's refusal to permit Northern Natural Gas Co. to sell gas to Northern States Power Co. The gas was to be used as boiler fuel at Northern States' Black Dog generating station near Minneapolis *(The Oil and Gas Journal, August 29, 1955, page 68)*.

Northern is expected to ask the FPC for a rehearing. Failing that, it is probable it will carry the issue to the courts.

It's precedent . . . This was not the first time the commission has passed on the question of end-use of gas. Over the past 10 years or so it has ruled on such sales several times. It has approved some, denied others.

But this was the first time the FPC has made conservation a major basis of a decision.

The Northern Natural case was decided by a 3-to-2 majority, with Commissioners Seaborn L. Digby and Frederick Stueck dissenting. Chairman Jerome K. Kuydendall sided with Commissioners Claude L. Draper and William R. Connole in the end result. He indicated he did not go along with the conservation argument. Kuydendall said he concurred in the decision because it was not shown that revenues from the boiler-fuel sales would be adequate to cover costs.

The decision, if finally upheld, would be a major victory for the coal interests. It brings into the open the long-standing attack on so-called inferior uses of gas by coal producers and miners. They have sought repeatedly to have controls applied by the FPC.

"There is no valid objection to giving matters of conservation, inferior and superior uses, and related matters the weight they may deserve," the FPC majority opinion said.

"And we have repeatedly held that the use of natural gas as boiler fuel is an inferior usage and that, while it is not to be denied in all situations, it should be permitted only on a positive showing that it is required by public convenience and necessity."

The Black Dog sale, the decision continued, "would aggravate the gas-supply problem which increasingly perplexes Northern and most other natural-gas pipeline companies as well in these days of diminishing reserves and increasing demand."

Gas premium fuel . . . The majority held there is an abundance of coal readily and economically available to the Black Dog plant.

"The same cannot be said of natural gas," it declared. "And the story is generally the same in most of the great fuel-consuming area.

"The limited quantities of such a premium fuel as natural gas, so uniquely adaptable to so many superior uses, as contrasted with the enormously more abundant supplies of coal, have important implications for the public interest which we cannot ignore in passing upon a proposed boiler-fuel sale.

"Obviously, in circumstances such as these, consideration of conservation must be given appropriate weight."

The FPC did not determine the commodity-cost figure of the 14.4 trillion cubic feet of gas which would be sold to Black Dog this year if the deal was approved. But the examiner, in his report, indicated cost would be several cents per 1,000 cu. ft. more than the price to be received.

The dissent . . . The majority ruling was sharply attacked by Digby and Stueck.

In a dissenting statement they claimed the position reached by "two of the majority"—Draper and Connole—"was based upon extraneous material founded upon speculative economic theories which were permitted to overshadow the facts."

"It is our firm conviction that although Congress gave this commission vast authority over .a determination of a policy with respect to conservation of water resources and planning of the development of the basins of navigable rivers, Congress gave us no authority to make a national policy or plan of conservation of natural gas," the two commissioners said.

"This inherent power reposes solely within the jurisdictions of the several states where such natural resource are found."

In this case, the dissent said, the examiner and at least one commissioner "has wandered into the conservation byway and been led astray from the mandatory path fixed by the statute."

Conservation of natural resources and the prevention of waste is a matter of concern. "But out of respect for the Natural Gas Act, which we have been appointed to enforce, we must confine ourselves within the limitations of our lawfully delegated powers and privileges."

Digby and Stueck pointed out that Congress never said the FPC should or can deny a certificate "because, as the presiding examiner stated, 'there has been a lack of demand for coal, its production has fallen off to a degree that the industry is in need of such relief as can be afforded in appropriate circumstances, as it can here by the denial of the pending application,'" they said.

Waste a threat . . . There is a "less theoretical but more practical" approach to the problem, the majority was reminded.

A large percentage of natural gas being transmitted in interstate commerce is oil-well gas. Any restriction on use of natural gas for industrial purposes actually would mean in many instances that this oil-well gas would be wasted. It is necessary that the gas be produced in a constant flow and amount because its production is incident to production of oil at daily rates fixed by the state.

"If this gas is denied the industrial markets on a theory of inferior use, it would have to be flared in the fields where it is produced," it was pointed out. "Of course, this would constitute a complete waste. Such flaring is generally prohibited by state conservation laws. Thus, we find that a FPC conservation policy could run into a direct conflict with state conservation authority.

"We are very much opposed to this commission's setting up an over-all standard for the end-use of natural gas," Digby and Stueck concluded. "We believe that the question of the end-use of gas as a fuel must be considered and determined upon the facts surrounding each individual transaction."

Offshore Sale Set

● Government will offer 161 tracts off Louisiana and Texas May 15

WASHINGTON.—Oil and gas operators will be given another chance in May to hunt for a fortune in the outer Cantinental Shelf.

More than 511,000 acres, in 161 tracts, are being offered for oil and gas leases by the Interior Department. Bids will be opened May 15 by the Bureau of Land Management in the St. Charles Hotel, New Orleans.

The areas to be opened up represent about 60 per cent of the 794,500 acres nominated in February by interested operators. This was the largest acreage nominated for any sale so far.

All but nine of the tracts offered are off the Louisiana coast. These nine, totaling only 23,040 acres, lie off Texas where activity so far has been limited.

Past sales . . . As a result of three previous sales, 189 leases totaling 647,528 acres have been sold off Louisiana. Only 46 leases for 216,909 acres have been made off Texas.

The May sale will include tracts in both shallower and deeper water than have been offered before. Some leases lie under as little as 20 ft., as against a minimum of 40 ft. heretofore. Some are as deep as 140 ft., compared with 100 ft. in the past. Tract sizes range from 1,440 to 5,000 acres, with a large block of the latter. But most are 2,500 acres.

Procedure . . . Leases will be made on sealed bids, each accompanied by a deposit of 20 per cent of the amount offered. Operators interested in two or more tracts must bid on each separately. The sky is the limit, but the bureau has set a minimum bid of $15 per acre.

Bureau officials estimate the sale may bring in another $100,000,000 or more in bonuses. More than $250,000,000 was taken in from the previous sales, $218,937,000 from leases off Louisiana and $31,795,000 from those off Texas. Well over $1,000,000 more has been added to the Continental Shelf take by first-year rentals.

Shelf leases run for 5 years at a rental of $3 per acre annually, payable in advance, until a discovery is made. The rental then shifts to a one-sixth royalty on production, with a minimum of $3 per acre per year. Once oil or gas is discovered, leases will continue as long as production pays, or drilling or well reworking operations are being conducted.

Big Pipeline Deal Planned

● Pacific Northwest will buy 25 per cent interest in Westcoast Transmission, expand producing subsidiary

HOUSTON.—Pacific Northwest Pipeline Corp. will purchase 25 per cent interest in Westcoast Transmission Co., Ltd., under a plan revealed last week.

The Houston-based pipeline company also announced plans to expand the operations of its production subsidiary in San Juan basin of New Mexico and Colorado. The subsidiary, Northwest Production Co., proposes to acquire leases on approximately 83,000 acres in that area.

New investments, totaling more than $50,000,000, will finance facilities for importing and selling Canadian gas in this country.

The Westcoast plan would give Pacific Northwest a major interest in the pipeline moving Canadian gas to the northern end of its system while permitting further development of gas supplies feeding into Pacific's line from the south.

C. R. Williams, Pacific Northwest president, said new funds will finance the laying of large-diameter pipe at the north end of its system and linking it with the Westcoast line at the Canadian border. Part of the money also will be used in construction of sales laterals and compressor facilities.

Most of the money will come from sale of first mortgage bonds and interim notes. Smaller amounts will be raised through bank loans and sale of approximately 280,000 shares of common stock. New financing will bring Pacific's total capitalization to about $217,000,000.

Pacific Northwest is nearing completion of a 1,487-mile line to move San Juan natural gas to markets along the upper West Coast. In addition, the company is laying about 800 miles of supply and sales laterals. The system is due to start operation in August.

Planned expansion will boost capacity of the Pacific Northwest system to 643,000 M.c.f. per day. The company will purchase about 300,000 M.c.f. of gas daily from Westcoast, starting about January 1958. This supply will come from the Peace River area in Canada through Westcoast's 650-mile line now being built to the U. S.-Canadian border near Sumas, Wash.

Plans for expanding production operations call for sale of stock in the subsidiary to holders of Pacific Northwest stock. The sale will increase Northwest Production Co.'s available cash to more than $3,000,000.

Refining BRIEFS

BATON ROUGE. — Esso Standard Oil Co., the marketing affiliate of Standard Oil Co. (N. J.), has launched a $40-million expansion program at its refinery here. About 2 years will be required to complete the work. Projects include facilities for increasing aviation gasoline output, lubricating oil, wax, and shipping facilities.

A $12-million ethylene-recovery unit also is planned along with additional equipment for butadiene production.

LOS ANGELES.—Southwestern Engineering Co., Los Angeles, has been awarded a $1,250,000 contract for constructing a 3,000-bbl. daily Platformer and a 2,100-bbl. daily Unifining unit at the Mount Vernon, Ind., refinery of the Indiana Farm Bureau Cooperative Association, Inc.

LAKE CHARLES, La.—A $6,250,000 coking unit will be built adjacent to Continental Oil Co.'s refinery here.

The unit will produce about 4,200 bbl. of gas oil daily and 85,000 tons of coke annually. Construction will start within a few weeks and be completed late next year.

Lake Charles Chemical Co., a new firm, will own the coker, but it will be operated by Continental as an integral part of its refinery. Conoco completed a $30,000,000 expansion here in 1955 which more than tripled capacity of the refinery.

VANCOUVER. — A tanker load of Alberta crude was picked up last week for delivery to the Wilmington, Calif., refinery of Richfield Oil Corp. The 90,000-bbl. load was the second tanker shipment of Alberta crude ever to enter the California market. The first shipment earlier this year sent 120,000 bbl. to Tide Water Associated Oil Co.'s refinery at San Francisco.

PORT ARTHUR.—A new 100,000-bbl. per day crude unit at Gulf Oil Corp.'s refinery here is expected to go into operation about April 1. The company recently put on stream a new 70,000-bbl. fluid catalytic cracking unit here.

How to Get Octanes?

Many routes are open, through reforming or combinations of processes, but a lot of complex factors are involved

SAN ANTONIO. — Refiners have a variety of roads to choose in reaching octane improvement. They can travel by isomerization, precise fractionation, second-pass reforming, alkylation, aromatics extraction.

Their problem is how to go, how much it will cost, and where are the pitfalls.

This was put squarely before members of the Western Petroleum Refiners Association at their annual meeting last week by T. W. Warren of Ethyl Corp., Detroit. He addressed the association on a paper jointly prepared with R. C. Kersten.

Warren declared that by 1958 essentially all virgin naphtha will be charged to catalytic reformers operating at various severities. With this industry saturation, the national pool octane will be about 93 research octane number with a TEL concentration of 2.2 to 2.4 ml. per gallon.

This means 30 per cent of the gasoline from this domestic pool can be made as premium grade with 98 R.O.N. and the remainder regular grade of 91 R.O.N.

What's ahead . . . The question then comes: Where do we go from here?

Warren explained that when going above the 93 R.O.N. pool, moderately severe reforming has serious limitations, especially when blending for 100-octane premium. The refiner then has to turn to other processes heretofore considered economical only as specialty operations. This interest is enhanced because high aromatic concentrations in cat reformed stock also reduce lead response.

Warren and Kersten took a 1,000-bbl. charge of 88-octane leaded (2.25 ml.) naphtha on a hypothetical journey to high octanes. Here are the routes, complete with signposts, price tags and detours:

. . . Catalytic reforming. When starting up a new unit, including investment, operating and labor charges, the cost of catalytic reforming will range from 3 to 7 cents per research octane number per barrel (R.O.N.B.), depending on octane number of the charge. If pool octane of the naphtha charge had been 90 instead of 88, improvement in R.O.N.B. would have been slightly greater and unit costs slightly lower. Once the unit is installed and the refiner has to increase severity to get more octanes, costs jump to 19.9 cents per R.O.N.B.

. . . Combination processes. Pool octane quality can also be improved by several combination processes.

Aromatics can be extracted and the nonaromatic reformate charged to a second reformer.

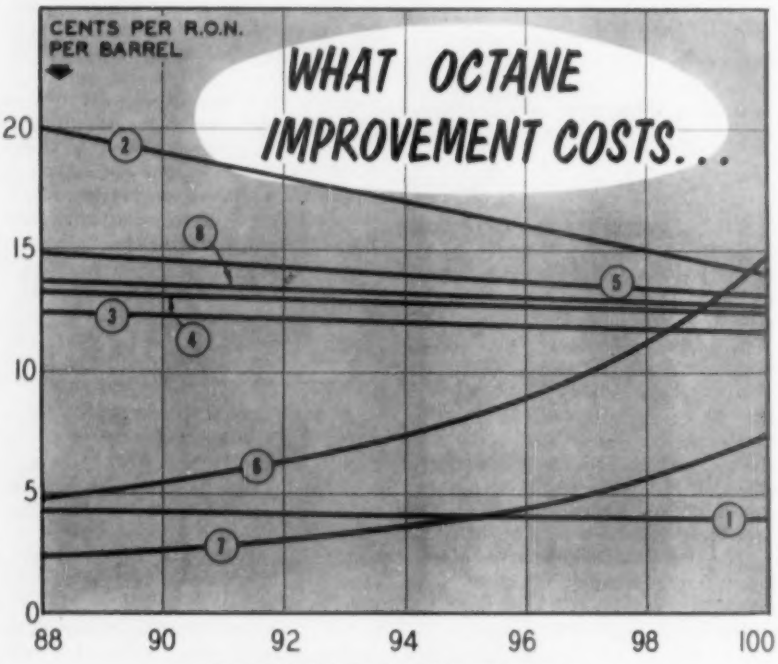
The nonaromatics can be recycled to the reformer specially enlarged for this purpose. Cat reformate can be thermally reformed and a cat poly unit installed to utilize light olefins from thermal reforming. Improvement costs via these routes range from 12 to 15 cents per R.O.N.B.

. . . Polymerization and alkylation. The refiner is faced with shifting economic conditions with poly and alky units.

With lower octanes, the poly unit is generally more favorable. The reverse is true with high octanes. Alternate-use value of the charge stock is the controlling factor in octane-improvement costs.

At olefin charge costs of 9.0 and 4.7 cents per gallon for the poly and alky processes, respectively, octane improvement will be on a break-even basis. With a 1-cent per gallon increase in olefin prices, unit costs will increase by 2.5 cents per R.O.N.B. in the poly unit and 1.2 cents per R.O.N.B. in the alky unit. Higher feed stock prices, meanwhile, could easily cause octane improvement costs to soar 15-20 cents.

. . . Isomerization. Pentane and hexane isomerization, well-known processes with only specialized applications



1. Cat reforming—new unit.
2. Cat reforming—increasing severity.
3. Reforming, aromatics extraction, reform raffinate.
4. Reforming, aromatics extraction, recycle raffinate.
5. Reforming, thermal reforming, polymerization.
6. Polymerization.
7. Alkylation.
8. Isomerization

to date, promise to come into their own.

Octane-improvement costs for pentane isomerization is 13.8 cents per R.O.N.B. With some butanes and hexanes produced and a high vapor-pressure product, it means net butane usage of the pool must be reduced. Hence, vapor-pressure effect, as well as unit operating costs and investment, have to be carefully defined in evaluating this method.

. . . Conflicts. Other specifications besides octane numbers will have a bearing on octane economics and throw up roadblocks, Warren noted.

For instance, engine warmup characteristics are tied to the 50 per cent A.S.T.M. distillation evaporation temperature. Severe reforming or reforming-extraction often will cause the reformate to have a high 50 per cent point. Hence the refiner may reform more severely to get light naphtha in the blend, bring down the 50 per cent point, and add octanes in the process. Likewise to maintain constant warmup characteristics, he might have to add light alkylate or isomerized light naphthas before otherwise justified.

Vapor-lock specifications of regular grade gasoline remain a critical point. Light ends from hydrocracking increase in the refinery pool as octane numbers are increased. Most of these will be blended with the lower grade motor fuel. And the volatility limits there can affect the entire octane improvement program.

. . . New techniques. These conflicts may be resolved by many techniques generally considered alien to octane improvement.

Precise fractionation will have to play a larger role. In many cases selective fractionation of cat reformates and cat cracked naphthas will eliminate the conflicts. More segregation of narrow fractions will mean more tankage. This also is true of blocked-out operation which will be required in many cases to avoid conflicts.

Operation at two severities, dual-purpose reforming units for C_5, C_6 and C_7-plus reforming, and different reforming-extraction combinations with the same equipment will become parts of a refiner's octane-improvement procedures.

Don't count on gas turbine . . .

. . . Piston Engine May Prevail

SAN ANTONIO—Is the gas turbine a will-o-the wisp? It might prove to be. At any rate, refiners should not write off the piston engine yet.

A great many improvements remain to be made in the conventional reciprocating engine, A. E. Cleveland of Ford Motor Co. told the W.P.R.A. last week. Some of them may well turn out to be more attractive than the turbine itself, and all are worth investigating.

Cleveland questioned the assumption that the gas turbine is the ultimate engine and proceeded to tell the refiners why.

In throwing a few preconceived ideas out the window, he projected several possible evolutionary forms of the piston engine. Some may require high octane and some may prove to be insensitive to antiknock quality. But their development will come gradually, he predicted, and refiners should have plenty of forewarning as to what types of fuel they will need.

Fuel injection . . . Scrapping the carburetor for fuel-injection systems is a logical development, Cleveland said.

It offers a lot of latitude in engine design and will probably be employed in gradually improved forms. At first it will resemble the carburetor, but as familiarity and public acceptance grow, fuel injection will free engine designers from the confines imposed by the centrally located carburetor and atmospheric pressure-gravity flow manifolding.

New combustion chambers can be built around injectors. Further, new control will be possible over the burning process. With these new possibilities to work with, designers may bring out engines with lower octane appetites and—ultimately—none at all. Present conceptions of the V-8 or Y-8 engine shapes and of valving may be altered.

Volatility looks critical . . . Assuming that fuel injection is in the offing, refiners will have to watch fuel front-end volatility closely.

Larger engines and lower hoods mean higher operating temperatures. Air conditioning, power steering, and power brakes also mean hotter fuel lines and greater tendency to vapor lock.

These trends, plus the probability that octane requirements may gradually be deemphasized, led Cleveland to warn refiners that they would probably exchange octane headaches for volatility headaches.

There are some indications that preignition may become less severe as compression ratios increase. Something will have to be done about spark plugs, and other means of starting ignition may be investigated.

Any future possibilities along these lines will be evolutionary, Cleveland said. The gradual changes necessitated by public acceptance and retooling costs will give refiners some advance warning on which way to jump. Overall, Cleveland believes that the pressure on octanes will lessen. But juggling distillation curves and providing fuels with better burning characteristics will keep life from getting dull.

New Fuel Additive

Product cuts deposits and engine octane requirement

SAN ANTONIO.—Latest member of the additive family is Skelly Oil Co.'s Keotane, a petroleum-derived compound which improves motor-fuel performance.

Tests run on a laboratory dynamometer and test cars found the additive to result in lower engine octane requirements and a decrease in engine combustion-zone deposits.

A fuel test-car engine with a new octane requirement of 89.2 was stabilized to a requirement of 94.7 using a commercial fuel with no additive. Following a 4,700-mile city-driving schedule during which base fuel plus Keotane was used, octane requirements dropped to 92.4, a decrease of 2.3 numbers.

This test unit was then driven 9,300 miles on crosscountry traveling with Keotane fuel. The octane requirement then stabilized at 92.7, 2.0 full numbers below the prior stabilized value obtained on the base fuel.

This was revealed to W.P.R.A. members by J. F. Wood and H. H. Belew, with Skelly in Tulsa.

A separate phase of the research program was carried out by an independent laboratory which conducted a 100,000-mile city-driving test. Cars operated on Keotane fuel exhibited a reduction in combustion zone deposits.

The 7½ to 1 compression-ratio engines showed an average 17.3 per cent (by weight) less deposits than those on base fuel. The 9 to 1 engines showed an average 10.8 per cent less deposits. Deposits from additive-fueled cars contained 18.2 per cent less lead than the cars on the base fuel. Crankcase oils contained an average of 6 per cent less lead deposits.

Gum deposits in the induction system were drastically reduced with as much as 55 per cent less gum formation in carburetors.

100 Octane Achieved

Once-through Platforming is producing 100-octane leaded gasoline, Universal Oil Products authors tell W.P.R.A.

SAN ANTONIO.—Refiners are making 100-octane leaded gasoline in once-through Platforming operations. Moreover, they are getting these results with two different charge stocks at a catalyst life of at least 30 to 35 bbl. per pound, using the R-5 Platforming catalyst.

These high-severity operations were reported last week by Davis Read and P. C. Weinert of Universal Oil Products Co. at the Western Petroleum Refiners Association meeting. The authors told the W.P.R.A. that two newer catalysts, R-7 and R-8, show better yield results and promise longer catalyst life than the R-5.

The performance of the R-5 catalyst and the indications of still better results from the newer versions lead U.O.P. to conclude that Platformers will be able to meet the higher octane requirements of the future without the need for adding regeneration facilities.

Commercial production of 97-98 leaded octane gasoline has been achieved in many cases, giving good yields at a catalyst life of 90 bbl. per pound, they reported.

If the newer catalysts give comparable performance at the 100-octane level, as they promise to do, then catalyst cost can be obtained at slightly over 4 cents per barrel of naphtha processed. This low cost, they conclude, would make it difficult to justify building and operating regeneration facilities on Platformers.

Mid-Continent naphtha yield . . . Read and Weinert cited performance records in Platforming three types of naphtha on a once-through basis.

Using the R-5 catalyst, an operator of an 11,000-bbl. per day Platformer obtained an 83.5 per cent yield of reformate from a heavy-Mid-Continent naphtha which tested 93.0 octane clear and 100.3 octane leaded.

These results were obtained over a long period during a run corresponding to a catalyst age from 22 to 32 bbl. per pound. When blended with butane to make gasoline volatility specifications, the research-octane rating increased to 93.5 clear and 100.4 leaded. A heavy 30-per cent cut of this reformate gave a clear octane rating above 102.

Kuwait yield . . . Kuwait naphtha, considered one of the most difficult stocks to reform, showed comparable octane ratings at lower yields.

A feed comprising 11 per cent aromatics and 22 per cent naphthenes yielded 76.5 per cent of Platformate testing 92.5 research-octane number clear and 100 research-octane number with 3 ml. TEL. These ratings were obtained on the whole Platformate fraction.

Gulf Coast yield . . . The third case of 100-octane reformate production which the authors noted concerned a Gulf Coast naphtha which contained 43 per cent naphthenes and 16 per cent aromatics.

This stock, considered lower in naphthenic content than the average from Gulf Coast crudes, produced a 90.6 per cent yield of Platformate over an R-5 catalyst. The whole reformate tested 94-octane clear, 99.5 with 2 ml. TEL and 100.3 with 3 ml. TEL.

The 1-week test took place at a catalyst age of about 22 bbl. per pound, after which operating conditions were changed back to normal and the run continued to a catalyst life of 118 bbl. per pound. The operator found that the higher severity test resulted in no indicated loss in catalyst activity.

U.O.P.'s two newer catalysts look better than R-5 for the coming high-octane operations which refiners anticipate. R-7 showed a yield advantage of about 1.8 volume per cent over R-5 in similar runs on a Pennsylvania naphtha. Pilot plant runs with R-8 indicate that it will better the R-5 yield by about 2 per cent on Kuwait stocks in comparable operating conditions. Both new catalysts are now available commercially.

Remote Test Finds Gas

CALGARY.—Shell Oil Co. and Canadian Gulf Oil Co. made an important gas discovery in northeastern British Columbia, about 160 miles northwest of Fort St. John.

The wildcat, the 1 Klua Creek, flowed gas at maximum rates of 8-12,000 M.c.f. per day on drill-stem test of the Slave Point-Middle Devonian formation. Location of the new gas strike is Lat. 58° 32' 10" N., and Long. 122° 22' W. Longitude. It is 30 miles northeast of Phillips 1 Tenaka dry hole and 40 miles north of Gulf States' 1 Bougie Creek gas discovery.

U. S. Doubles Claims

Jersey Standard, Socony accused of overcharges

NEW YORK.—The Government has nearly doubled the sum it seeks to recover from two major oil companies in a foreign oil overcharge suit.

Federal officials are suing Standard Oil Co. (N. J.) and Socony Mobil Oil Co., Inc., charging that the companies and a subsidiary of each collected too much for Middle East oil they sold countries receiving foreign aid.

Federal Judge Gregory F. Noon allowed the Justice Department to amend its original complaint here last week. In the original suit filed in 1952, the Government charged that Jersey Standard and Esso Export Corp., its subsidiary, received $35,862,288 too much for oil sold to the Economic Cooperation Administration for Marshall plan countries. The oil was sold from 1949 through 1952.

In the same period, the Government says Socony Mobil and its subsidiary, Socony-Vacuum Overseas Supply Co., received $14,188,498 more than it was entitled to.

The amended suit asks recovery of $111,565,109—all the money paid Jersey Standard—or a judgment of $68,309,794 in overcharges. The full figure asked from Socony is $49,127,626, or overcharges of $27,760,684. The amended suit covers the period from September 1950 to August 1952.

The legal question involved is one of interpretation of the ECA regulations covering the oil-purchase contracts.

Products Pipeline Started

HOUSTON.—Construction is under way on a 6-in. products pipeline to move butane from Nueces County, Texas, to Petro-Tex Chemical Corp.'s butadiene plant near here.

The line, originating at Tennessee Gas Transmission Co.'s natural-gasoline plant near Banquete, Tex., will be approximately 200 miles long. It is being built by Tennessee Products Pipe Line Co., a subsidiary recently formed by T.G.T. The parent company is part owner of the butadiene plant.

The subsidiary also is building a fractionating plant on a 50-acre site along the Houston Ship Channel. Butane, propane, and natural gasoline will move through the pipeline in a mixed stream and be separated at the ship-channel site *(The Oil and Gas Journal, January 16, page 83)*.

Products not used in the nearby butadiene plant will be stored for later shipment.

SEVEN CAT* OILFIELD ENGINES POWER DIXIE'S NEW OFFSHORE RIG

These three D397 Engines power the drawworks for Dixie's offshore rig at Terrebonne Bay.

When Dixie Drilling Co., Houston, Tex., equipped its new offshore rig, it specified seven modern, heavy-duty Caterpillar Oilfield Engines for power. They include three D397s on the drawworks, a D364 on the mud pump, a D337 on the coring line and two D318 Electric Sets.

These four-cycle oilfield engines are ready to work 24 hours a day for years—there are some with over 100,000 hours on their meters! They offer the dependability so necessary in an offshore operation.

And by standardizing on Cat Oilfield Engines, operators and mechanics are familiar with one make of machinery, so they do their jobs faster and easier. Too, parts inventory can be kept low since many parts on these engines are interchangeable.

But more than that, Dixie took advantage of Caterpillar flexibility. There is a wide choice of attachments, giving power tailored to your own special needs. You enjoy a choice of torque converter drive, fluid couplings, or direct drive arranged in the way which helps you do your job best. Air controls and air clutches give you swift, smooth, flexible operation.

And there has been a continual parade of engine and electric set improvements coming from Caterpillar. For instance, the new D337 (Series F) has been turbocharged to produce 310 HP maximum at 2000 RPM. All Cat Engines are offered with a choice of three starting systems—air, electric and gasoline. And there are many other recent advances in this and other Caterpillar Oilfield Engines.

Now is the time to stop in and see your nearby Caterpillar Dealer. He has a full line of new engines and electric sets all designed to save you money, time and trouble.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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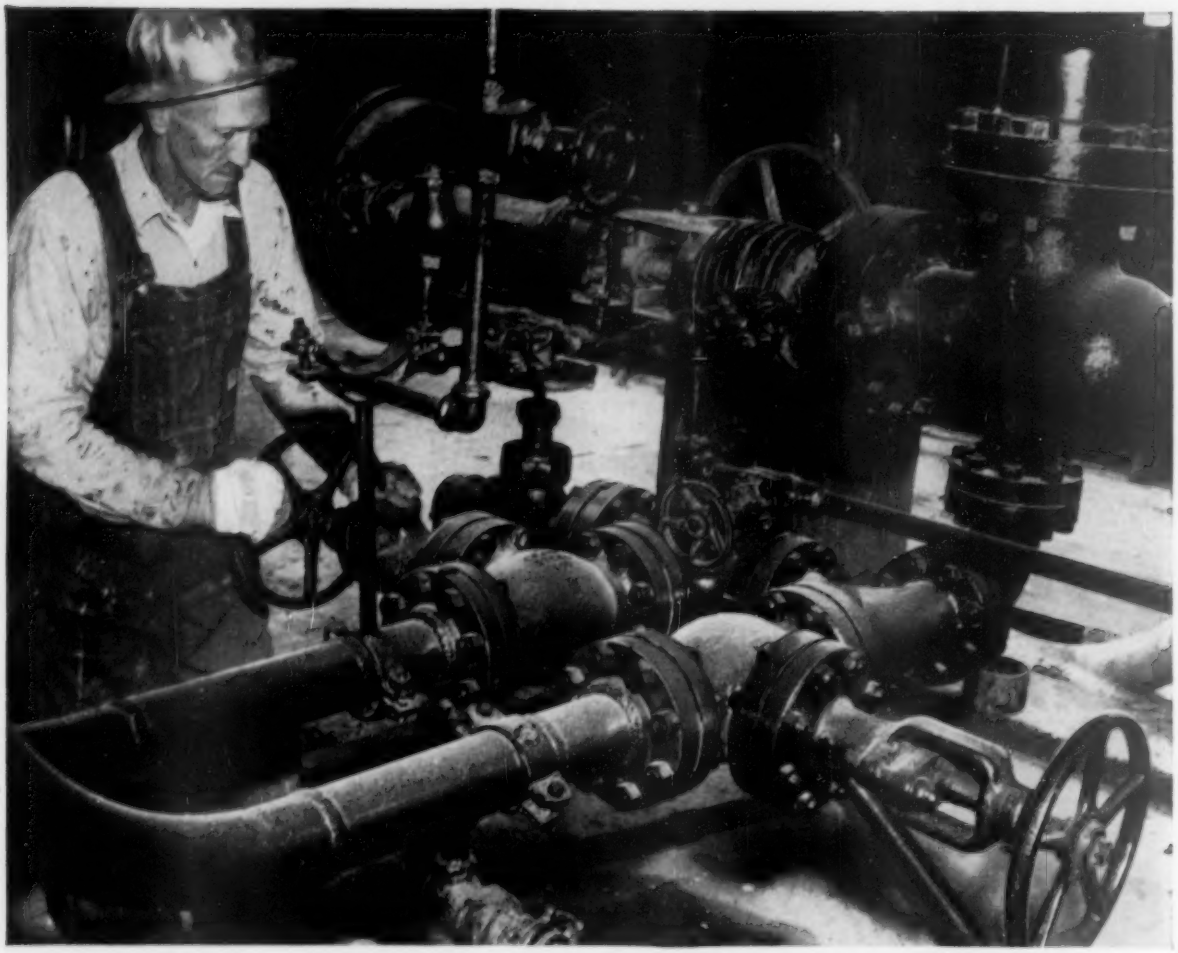
MODERN HEAVY-DUTY OILFIELD ENGINES



They're saving with these Crane valves on 850° F. draw-off service

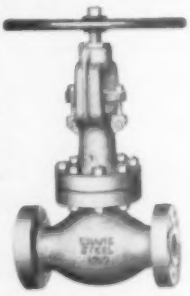
THE CASE HISTORY—What does it cost to keep a valve working? The answer can vary widely—as the DX-Sunray Oil Co. knows after long experience with Crane maintenance-saving valves.

For instance, take the 3-inch, 600-pound cast steel valves shown here. These No. 171X Crane globes were installed in 1945 on draw-off lines from reaction chamber. They handle oil at 850° F.

In 9 years' continuous service with frequent operation, these valves have cost no more than simple routine maintenance. They've shown no leakage, given no trouble of any kind. They're still as dependable as new.

Outwardly Crane valves look like many others. The difference that's important to you is mainly inside. It's in Crane's greater skill and care in casting steel—in developing Exelloy seating—in operating design—and in Crane's way of testing valves. That's why they give extra long, low-cost service.

Crane offers you complete selection in steel gate, globe, angle and check valves in all pressure classes—in sizes up to 24 inches.



For valuable help in specifying and ordering, call your local Crane Representative.

CRANE VALVES & FITTINGS

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Oil Importers Stand Pat

Companies still planning to ship in 841,400 bbl. daily in first 6 months; it's a 15.9 per cent gain over last year

IMPORTING companies apparently are standing pat on their plans to bring in a large volume of foreign crude during the first half of the year.

Companies reporting to the Texas Railroad Commission have scheduled crude imports for the first 6 months at the rate of 841,400 bbl. daily. This is a gain over last year of 115,700 bbl. daily or 15.9 per cent. The reports also represent no change in plans in the past month.

But the gain in foreign crude receipts will be even larger than that reported to the commission. This is revealed by comparisons of reports to the commission with total crude imports tabulated by the Bureau of Mines.

Canada in picture . . . For the first 3 months of 1955, companies reporting to the commission accounted for all but 15,900 bbl. daily of crude imports.

Most of this crude was brought into the Duluth, Minn., customs district by companies not operating in Texas and not reporting to the Railroad Commission. However, by the last quarter of 1955 the difference between total crude imports reported by the Bureau of Mines and partial imports tabulated by the commission had increased to 47,700 bbl. daily.

If this difference continues to grow, the actual gain in crude imports for the first half will be larger than the 15.9 per cent increase shown by reports to the commission.

Most of the extra crude will come from Canada. Some Canadian crude was delivered to Michigan refineries in February with increases scheduled for the coming months *(The Oil and Gas Journal, February 20, page 89)*. Also, a continuation of near normal tanker rates will make it profitable for California refiners to use some Canadian crude.

Fluctuations . . . Product imports by companies reporting to the commission will be less than a year ago for each of the first 4 months of this year.

Plans for May and June call for slight increases over the same months last year. The big gain for August, 28.2 per cent, can be charged more to the big drop during that month last year than to any increase in 1956. The January-July average for this year will be 0.2 per cent less than last year.

Reports to the commission accounted for 80.3 per cent of all product imports in 1955. Total product imports for 1955 averaged 466,800 bbl. daily,

What the Companies Told the Railroad Commission

(Thousands of barrels daily)

	Actual*		Forecast*				
	Feb.	Feb.	Mar.	Apr.	May	June	July
CRUDE—EAST COAST:	1955	1956	1956	1956	1956	1956	1956
Atlantic Refining Co.	65.8	82.3	65.2	65.2	65.2	65.2	65.2
Cities Service Co.	11.6	12.7	23.6	36.7	32.1	40.9	32.1
Eastern States Petroleum Co.	7.3	24.6	22.2	20.5	22.5	22.5	27.0
Gulf Oil Corp.	159.0	112.0	151.0	122.0	134.0	134.0	134.0
McBride Oil & Gas Corp.	3.9						
Phillips Petroleum Co.	14.2		11.6	12.0	11.6	12.0	11.6
Sinclair Oil Corp.	52.2	66.4	81.0	61.9	80.0	75.0	71.0
Shell Oil Co.		1.2	1.0	1.0	1.0	1.0	1.0
Socony Mobil Oil Co., Inc.	73.6	58.9	69.8	66.5	66.5	66.5	66.5
Sohio Petroleum Co.		1.8	1.9	2.0	2.0	2.0	1.9
Southwestern Oil & Refining Co.	4.1	3.9		3.7	3.6	3.7	(¶)
Standard Oil Co. of California	98.3	83.8	83.2	83.2	83.2	83.2	83.2
Standard Oil Co. (Ind.)	15.2	16.6	10.2	13.3	16.3	16.9	20.1
Standard Oil Co. (N. J.)†	77.0	83.0	79.0	79.0	79.0	79.0	79.0
Sun Oil Co.	28.8	29.2	34.6	25.8	29.5	57.5	57.3
The Texas Co.	65.9	72.2	74.7	41.7	69.2	83.5	75.8
Tide Water Associated Oil Co.	9.6	7.2	18.4	15.0	15.0	15.0	15.0
Total East Coast	686.5	655.8	727.4	649.5	710.7	757.9	740.5
CRUDE—WEST COAST:							
Shell Oil Co.		44.1	39.0	33.6	39.4	18.7	18.1
Socony Mobil Oil Co., Inc.	22.3	35.3	31.7	37.5	37.5	37.5	39.5
Standard Oil Co. of California	17.1	9.2	22.2	22.2	22.2	22.2	22.2
The Texas Co.	6.1	15.1	11.7	36.3	30.2	31.8	24.5
Tide Water Associated Oil Co.	15.3	25.7	66.6	42.3	56.9	46.1	47.5
Total West Coast	60.8	129.4	171.2	171.9	186.2	156.3	151.8
Total crude	747.3	785.2	898.6	821.4	896.9	914.2	892.3
PRODUCTS:							
Asiatic Petroleum Co.	4.1	1.1	3.9	4.5	4.6	4.5	4.3
Cities Service Co.	2.5						
Eastern States Petroleum Co.	16.0	15.9	10.0	10.0	10.0	10.0	10.0
Gulf Oil Corp.	4.0	6.0		4.0	7.0	7.0	7.0
Shell Caribbean Petroleum Co.‡	171.0	207.0	143.0	102.0	90.0	92.0	87.0
Shell Oil Co.	30.4	17.5	22.7	19.5	20.9	22.1	22.4
Sinclair Oil Corp.	2.3						
Socony Mobil Oil Co., Inc.	7.0	3.7	8.9	8.9	8.9	8.9	8.9
Standard Oil Co. (Ind.)§	18.7	31.1	29.8	29.3	21.5	17.0	19.4
Standard Oil Co. (N. J.)†**	263.0	194.0	185.0	174.0	174.0	174.0	166.0
Total products	519.0	476.3	403.3	352.2	336.9	335.5	325.0
Total crude and products	1,266.3	1,261.5	1,301.9	1,173.6	1,233.8	1,249.7	1,217.3
Bonded fuel included	72.9	62.2	72.7	88.4	88.3	88.9	88.0

*From company reports to the Texas Railroad Commission. †Based on quarterly estimates. ‡Imported by independent distributors. §Received through suppliers who can furnish either domestic or foreign oil. ¶Unreported by company but an average of 3,700 bbl. daily included in totals. **Includes bonded drawback for foreign flag international bunkers as follows: February, 37,000 bbl. daily; March, 34,000 bbl. daily, second quarter, 45,000 bbl. daily; and July, 44,000 bbl. daily.

CRUDE IMPORTS*
(Thousands of barrels daily)

	1955	1956	Per cent change
January	716.8	730.5	1.9
February	747.3	785.2	5.1
March	721.4	898.6	24.6
First quarter	727.9	805.2	10.6
April	669.4	821.4	22.7
May	721.7	896.9	24.3
June	779.6	914.2	17.3
Second quarter	723.5	877.7	21.3
July	762.5	892.3	17.0

PRODUCT IMPORTS*
(Thousands of barrels daily)

	1955	1956	Per cent change
January	508.1	483.4	— 4.9
February	519.0	476.3	— 8.2
March	451.8	403.3	—10.7
First quarter	492.0	453.9	— 7.7
April	356.9	352.2	— 1.3
May	327.1	336.9	3.0
June	306.7	335.5	9.4
Second quarter	330.2	341.5	3.4
July	253.6	325.0	28.2

*From reports to the Texas Railroad Commission.

according to the Bureau of Mines. Companies reporting to the commission brought in products at the rate of 374,800 bbl. daily, leaving a balance of 92,000 bbl. daily to cover receipts by industrial consumers, oil companies not reporting to the commission, and federal agencies.

Product import totals in the accompanying tables include all bonded fuel for bunkering, even that used for bunkering foreign flag vessels in international trade. This material is considered a part of imports for consumption and of domestic demand by reporting federal agencies.

Road Octanes Hold Up

Ethyl study shows sensitivity affects road ratings less than many thought; vapor pressures can be raised safely

NEW YORK. — The increased aromatic content of current gasoline, due largely to higher levels of catalytic reforming, has boosted fuel sensitivity. But this higher sensitivity hasn't affected road octane ratings as much as many observers believed.

These characteristics and much other new information on today's gasoline are reported in an annual review of gasoline quality compiled by Ethyl Corp. This valuable reference material gives the most complete picture of gasoline quality ever assembled.

Gasoline now contains more aromatics than olefins, and sensitivity of premium grades has risen accordingly. The spread between motor and research ratings has increased from 8.5 to nearly 10 octane numbers in the past 5 years. During the same period the regular spread has moved up from 5.5 to 6.0 numbers.

But, to the surprise of many, the road octanes of 1954 and 1955 cars remain on the average quite close to the research rating.

A further conclusion to be drawn from this very comprehensive report is that refiners could raise the vapor pressure of their gasoline by blending more butane. Results from four major marketing centers indicate that Reid vapor pressure could be boosted 1 to 1½ lb. without damage from vapor lock.

Content, sensitivity . . . Analysis of 190 samples of gasoline taken in 14 representative marketing areas last November show premium grade samples varying in aromatic content from 10 to 46.1 per cent.

The arithmetic average of all 95 premium samples is 25.5 per cent aromatics, 24.1 per cent olefins, and 50.4 per cent saturated hydrocarbons. Regular grades averaged 18.5 per cent aromatics, 15.3 per cent olefins, and 66.2 per cent saturates.

Sensitivity of gasoline, expressed in octane number spread between research and motor ratings, was only three numbers for both grades during 1930-1936. The spreads increased to 9.8 octane numbers for premium and 5.8 for regular in 1955.

Premium Reid vapor pressure has edged up from 10.3 lb. for winter and 8.0 for summer gasolines in 1948 to 11.0 and 8.5 respectively in 1955. Regular R.v.p. stood at an average of 10.2 for winter and 8.0 for summer in 1948. Last year it showed 11.3 and 8.6 lb.

Purity . . . The Ethyl report shows that sulfur content for both grades stood at an average weight per cent of 0.062 last summer as compared with 0.070 for premium and 0.068 for regular grades during the winter of 1954-55. This is well below the 0.25 per cent level which is considered safe for finished gasolines. Gum content for premium runs 3 mg./100 ml. and 2 mg./100 ml. over the past year.

Reviews of distillation curves on both grades show a decline in the 90 per cent point on regular grade in 1955.

Requirements, road octanes . . . On octane requirements of cars, the survey shows that 50 per cent of the 1955 models were satisfied with 88.5 research octane while 95 per cent were satisfied with 95 octane.

Of all cars on the road last year, 50 per cent were satisfied by 82.0 octane fuel; 92 octane satisfied 95 per cent of all cars.

The Ethyl survey presents a clear picture of the relationship of road octane to both research and motor ratings in current fuel-vehicle combinations. Road octane ratings were run on eleven 1954-model cars and twenty-two 1955 models, representing approximately 90 per cent of the production for these years. Several vehicles of each model were tested using a primary reference fuel of average sensitivity.

A plot of this study shows that average road-octane ratings fall about three-quarters of the distance from motor to research ratings. Only three cars showed road ratings closer to the motor than the research octane. One had a road rating higher than research and in several cars the road rating roughly equalled the research laboratory rating. The bulk of the 33 models tested rated the primary reference fuel very close to the three-quarter mark nearest the research rating.

The report includes an important study of vapor-locking tendencies of gasoline marketed last summer. Using the V/L ratio, Ethyl engineers derived values showing the permissible Reid vapor pressure increase to maintain a V/L ratio of 20 at the ambient temperature of the various cities. These values indicate the amount of butane which can be added to the various gasolines without encountering vapor lock.

Permissible R.v.p. increases on this basis were reported for four cities. Their averages looked like this:

	No. samples	Avg. R.v.p.	Ambient temp.*	R.v.p. inc.†
Met.-N. Y.-N. J.:				
Premium	11	8.5	105.4	1.71
Regular	12	8.6	105.2	1.57
Chicago:				
Premium	12	8.9	99.0	0.65
Regular	11	9.4	96.9	0.66
Los Angeles:				
Premium	11	8.3	106.4	1.75
Regular	11	8.3	109.9	2.34
Houston:				
Premium	13	8.5	103.4	0.91
Regular	13	8.6	104.2	1.14

*Average permissible at calculated V/L 20. †Average permissible to V/L 20 at ambient temperature.

On the basis of the four major cities sampled it appears refiners could boost octane blending to raise premium fuel R.v.p. by about 1¼ lb. and regular nearly 1½ lb.

North Texas Flood Sought

AUSTIN.—Miami Operating Co. has asked the Texas Railroad Commission to approve a unitization agreement and water flood for 1,005 acres in the Kempner area of KMA field of Wichita County, North Texas.

Miami told the commission the proposed unit expects to recover an additional 1,850,000 bbl. of oil from 607 acres of the 3,900-ft. KMA lime pay underlying the proposed unit.

There are 43 stripper wells in the unit area—about 20 of them slated for conversion to water-injection service. Cumulative production to the first of the year was 1,731,861 bbl.

Miami reported that 100 per cent of working interests and 99.9 per cent of royalty interests on a participating-interest basis have approved the unit agreement. Participation factor is based on acre-feet of KMA lime pay.

DESIGNED for RUNNING

As part of the Drill String

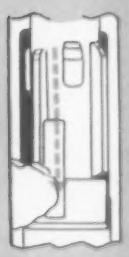
Locked Position (for drilling)

Tripped Position

The SHAFFER-WAGGENER BUMPER SAFETY JOINT protects 2 WAYS!

For safeguarding your drilling well against the hazards of a stuck drill string, nothing surpasses the *two-way* protection provided by the Shaffer-Waggener Bumper Safety Joint. Here's a tool—*specifically designed to withstand the continuous torque and vibration of running directly in the drill string*—that can be relied upon to provide sharp down-jarring at any time the drill string becomes stuck. Or, with equal ease, it provides quick release from the stuck portion for recovery of the string above the tool.

No other tool—or combination of tools—provides the ruggedness, the versatility, the simplicity, the all-around drill string protection you get in the Shaffer-Waggener Bumper Safety Joint!



TO RELEASE, *tool is tripped, moving drive keys downward.*

1 RUN THE TOOL IN THE DRILL STRING—it's specifically designed to withstand the continuous torque and vibration of modern drilling operations. The tool has been used successfully throughout the world—and at world-record depths. At all depths it provides the extra safety of double drill string protection!

2 TO USE FOR JARRING, simply slack off weight of approximately 2,000 feet of drill pipe onto the tool. This weight releases the tripping mechanism and strikes a sharp downward blow. Raising the string automatically re-sets the tool for another blow—and repeated blows can be struck as fast as the string can be raised and lowered. *It's as simple and positive as that!*

3 TO RELEASE, in the event jarring will not loosen the stuck string, simply trip the tool and apply reverse torque as the string is slowly raised. One-sixth turn of the drive keys rotates them into an unlocking slot so that complete release is obtained by continuing to raise the string.

LEFT TORQUE *then rotates drive keys into unlocking slot as string is raised.*

4 THE TOOL TRANSMITS TORQUE LOADS in *either* direction through drive keys—*not* through threads—a *big* advantage over conventional safety joints. In fact, until the definite releasing operations are performed in proper sequence, the tool remains the strongest joint in the drill string. Yet by first tripping the tool, it can be quickly released.

5 THE TOOL CAN BE RE-CONNECTED in the hole by simply using the recovered portion at the bottom of a fishing string for mating with the portion left on top of the fish. It's simple, quick!

Added Proof

These typical job records further show the all-around utility of the Shaffer-Waggener Bumper Safety Joint . . .

3½ MILES DEEP: On this job, the Bumper Safety Joint was released from stuck drill collars at 18,136 ft. (almost 3½ *miles* deep) requiring only 2¾ turns of reverse torque *at the table.* Recovered portion of tool was then attached to bottom of fishing string, run back into hole and connected to fish. After jarring, bit and drill collars were freed, leaving hole completely clean!

3 MILES DEEP: On another job at 16,883 ft. (over 3 *miles* deep) a Bumper Safety Joint being run in the drill string greatly simplified recovery of a parted and dropped string, again leaving hole completely clean!

SLANT HOLES—a problem with conventional safety tools—are no obstacle to the Shaffer-Waggener Bumper Safety Joint. Even directionally-drilled wells with extreme slant are handled in stride.

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Five reasons why Youngstown Electric Weld Line Pipe is your best buy: (1) It bends readily; (2) Wall thickness is uniform; (3) Line up characteristics are excellent; (4) Weldability is outstanding; (5) Long lengths save you time and trouble. The Youngstown Sheet and Tube Company, Youngstown 1, Ohio. Sales and service offices throughout the oil and gas producing areas.

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Price Drive Opens

● TIPRO first big group to campaign for increase in price of crude oil

HOUSTON. — A campaign for a crude-oil price increase of approximately 20 per cent gained momentum last week with Texas Independent Producers and Royalty Owners Association spearheading the drive.

The association's executive committee authorized TIPRO President A. P. King, Jr., to appeal to purchasing companies for higher prices. The decision was made at a closed session of the committee. It met here March 15 to outline proposals to be presented at the association's annual meeting next month.

The committee made only a terse announcement of its plan, explaining that the proposal is intended "to offset increased costs." Several other industry leaders have discussed the growing demand for a crude price increase recently *(The Oil and Gas Journal, March 19, page 128)*.

However, the TIPRO group became the first major organization to campaign publicly for higher crude prices. It also is the first such group to specify the amount of increase sought—"approximately 20 per cent."

Last general increase in the price of crude came in 1953 and amounted to 25 cents a barrel. The 20 per cent proposal would raise the average price now by about 55 cents.

Other issues . . . On most other major issues confronting association members, the executive committee delayed positive action.

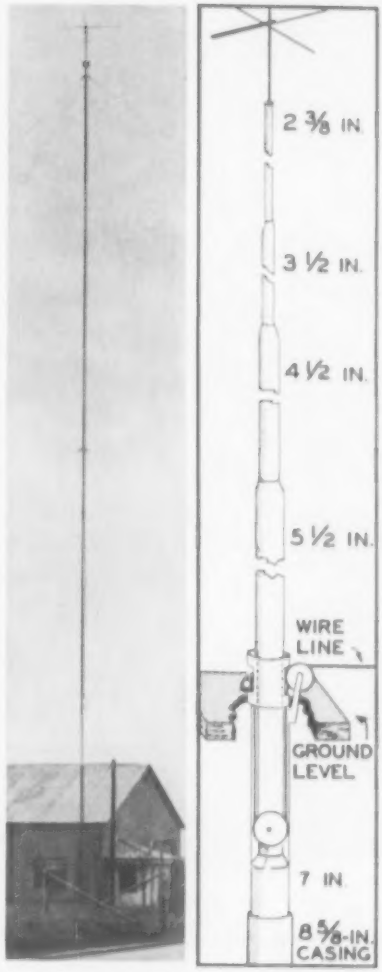
Several controversial plans for easing price controls on natural-gas producers were discussed at length. Among the proposals which "may be laid before the general membership" at TIPRO's April 15-17 meeting in Dallas are:

. . . Legislation making gas-pipeline companies "common carriers" subject to regulation by the Interstate Commerce Commission.

. . . A "divorcement bill" to divest gas-transmission companies from production arms of the industry.

. . . Restraints on importation of natural gas from Canada and Mexico "until the price of Texas gas equals the price of this gas at the border."

. . . State legislation requiring the Railroad Commission to certify that new commitments of gas for interstate commerce will not jeapordize the supply for local demand.



Unique Tower Built

Radio tower retracts into hole in ground for repair

NOWATA, Okla. — Oil-field equipment and pipe have been used to build a field communications radio tower that has two big advantages over a new fabricated tower.

It's cheaper—costs only one-third as much.

It's simpler and safer to repair.

The tower was erected by the Climax-Brundred Water Flood Division of Climax Molybdenum Co. in Nowata County, Oklahoma. The unusual aspect of this homemade, 154-ft. tower is that it retracts into a hole in the ground.

The first step in the project was to drill a 10-in. hole 200 ft. deep with a company spudder. Used 8⅝-in. casing was run. Each joint of pipe for the tower was made up and lowered into the hole much as in a rotary-drilling operation.

No derrick was needed. The entire string was lowered into the hole by wireline and a winch truck. It's raised the same way.

When it's time to repair the antenna or change a beacon light, the tower is lowered into the hole. The operation usually takes less than an hour. And it does away with the dangerous job of climbing the slender structure and working on it 154 ft. in the air.

Penn Prices Raised

20-cent hike puts $4.20 tag on Bradford crude

BRADFORD. — Pennsylvania Grade crude received its second price boost of the year, effective March 16.

The latest change represents an increase of 20 cents a barrel for most grades, bringing the posting for Bradford crude to $4.20 a barrel.

Joseph Seep Purchasing Agency for South Penn Oil Co. reported that increased demand for crude from the area was the reason for higher postings.

The latest increase is the seventh in the upward trend for Pennsylvania Grade prices that started in the fall of 1954. During September of that year, Bradford crude was selling for $3.23 a barrel. The current posting represents a net gain of $0.97 a barrel in the past 18 months.

The new quotations by Joseph Seep Purchasing Agency are: Bradford, $4.20; Middle District, $4.07; Southwest Pennsylvania, $3.78; and West Virginia, $3.66.

Quaker State Oil Refining Corp. raised Buckeye crude $0.20 a barrel to $3.60. Ashland Oil & Refining Co. posted $3.07 for Zanesville crude, an increase of $0.05.

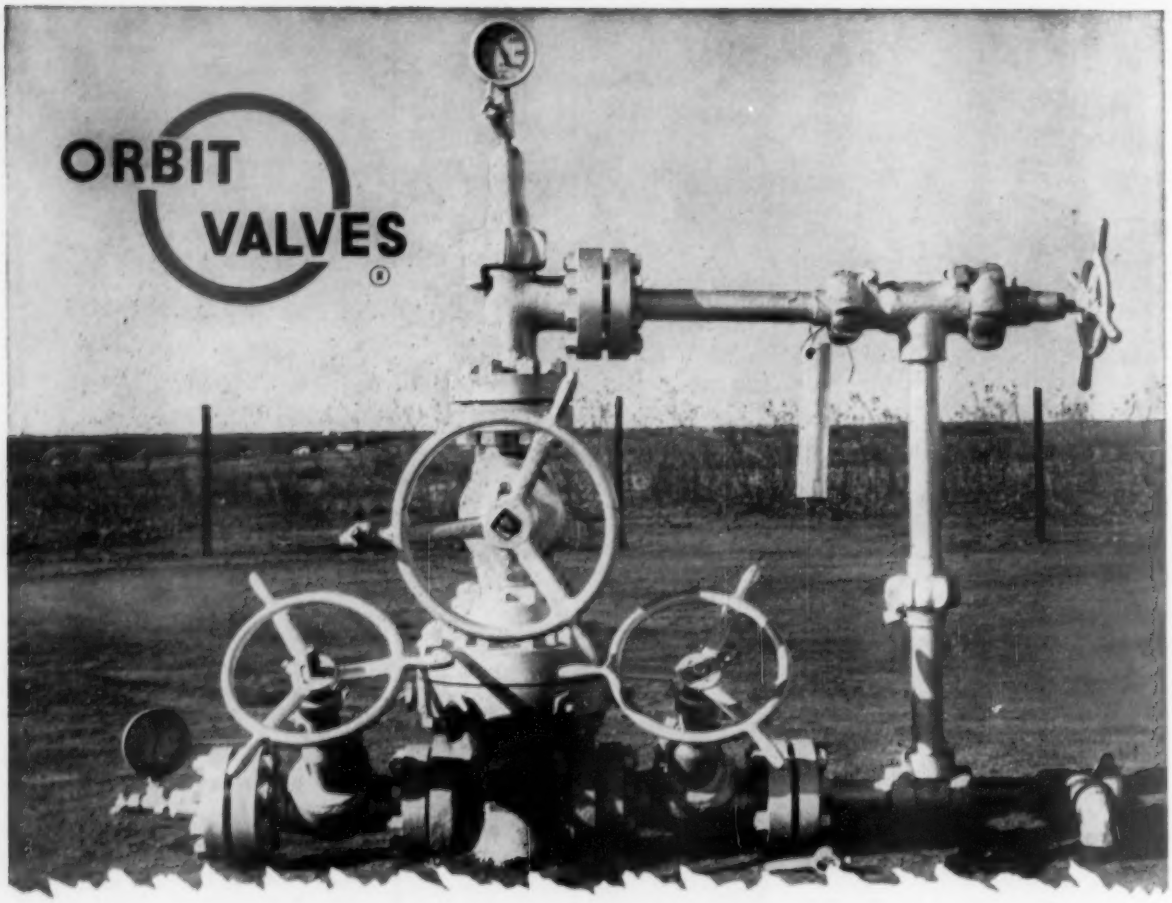
Tidelands Settlement Near

SACRAMENTO. — California's disputed claim to a share of oil and gas revenues from Long Beach's tidelands may be settled before the end of the current legislative session.

Representative of the state and city have ended their first meeting in at atmosphere of "mutual understanding." Another meeting is slated after Long Beach officials meet with their city council.

The controversy involves ownership of $110 million in accumulated tideland revenues now held by Long Beach and division of future tidelands income. The courts have ruled the state is entitled to half the oil revenue and all the natural gas income from the city's tidelands. A bill pending before the legislature would require the city to transfer the money to the state treasury.

If the disputants can come to terms in the current talks, it is expected a compromise bill will be introduced.



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INTERNATIONAL

Pemex to Hike Drilling

With 20 new rigs ordered, Mexican Government firm plans 72 wildcats in 1956, 31 per cent boost in total drilling

PETROLEOS MEXICANOS plans to drill at least 450 wells this year with the aid of 20 new rigs.

Delivery began this month and will be completed by November. The rigs and subsidiary field equipment, such as tractors and bulldozers, were ordered in the United States *(The Oil and Gas Journal, February 13, page 97)*.

The rigs will bring Pemex' total to 98. Of the 78 in operation at present, 25 have been assigned to drill 72 wildcats in new areas this year. The remaining 53 rigs on hand will drill 261 wells to develop and extend present producing areas. Pemex expects the new equipment to drill 117 wells in established areas, provided deliveries are on schedule.

Last year, 344 wells were completed.

The new rigs will bolster operations in three districts and will be placed in service as soon as possible. Final allocations for each area have not been made, but the districts and the role each has in the Mexican oil industry are:

. . . Southern zone. This includes fields in the Isthmus of Tehauntepec and state of Tabasco, which supply the newly expanded 50,000 bbl. daily Minatitlan refinery.

Besides serving the local area, products are moved by pipeline across the Isthmus to the Pacific Coast, then by tanker to West Coast ports previously dependent upon imports. Ciudad "Pemex" also will be built in this area. The city will consist of self-sufficient facilities built around a refinery and gas-absorption plant. Output will supply fuel for industry, expected to flourish because of rich natural resources in the region.

. . . Northeastern zone. Gas fields in this area, along the U. S. border, will supply gas to the U. S. if the Federal Power Commission approves.

The Texas Eastern Transmission Corp.'s 20-year contract with Pemex calls for deliveries starting at 100,000 M.c.f. daily to be built up to 200,000 M.c.f. daily as reserves are established *(The Oil and Gas Journal, October 3, 1955, page 98)*. A 300,000 M.c.f. daily gas-absorption plant completed last September would process the gas sent across the border.

. . . North and central zone. Fields in this area, along the Gulf of Mexico and in the state of Veracruz, are the center of crude production. Poza Rica and Golden Lane fields are in this area. The region accounts for about 85 per cent of Mexico's 240,000-bbl. daily output and is the source of exported oil.

Jamaican Wildcat Staked

Location for its first wildcat in Jamaica has been staked by Jamaican Stanolind Oil Co., subsidiary of Stanolind Oil & Gas Co., Tulsa.

The test, to be spudded early this spring, will be near Negril, on the western tip of the Caribbean Island. The location is on the Santa Crus anticline near the site of the wildcat drilled last June by Base Metals Mining Corp., Ltd., whose concession Stanolind has taken over. Base Metals maintained 25 per cent of the concession, which covers the island.

Bottomed at 6,300 ft., the 1 Base Metals had five shows of oil or gas. It was found to be off structure. The new location was picked on the basis of a month's photo and surface geological study, seismic work, and core drilling.

Associated Noble Corp. has the drilling contract. The company will use a light rig rented from Base Metals. A heavy rig will be shipped to Jamaica for a second test, projected to 10,000 ft. or more.

Russians Now Drill Without Using Bit

RUSSIA claims to have developed a method of drilling without a bit which is now being employed successfully by the Kuibyshev oil combine.

The Soviet newspaper Trud, official organ of the All-Union Central Council of Trade Unions, describes the new process as follows:

"Special charges are fed into the hole at specific time intervals. Upon leaving the drilling tool, the charges explode and deepen the hole. The broken rock is carried to the surface by a flushing fluid under pressure from pumps."

The Russians say the big advantage of "bit-less drilling" is the saving of time ordinarily spent in raising and lowering pipe in the hole to change the tool. "By the most modest estimates," Trud declares, "the new method increases the amount of hole made in one trip of the tool by 10-15 times."

Pakistan Tests Due

Rigs shipped for Stanvac and Nelson Hunt wildcats

A RIG shipped by Hunt International Petroleum Co. is expected to arrive in West Pakistan about April 1.

The equipment will be set up about 80 miles west of Karachi in the Dhak area along the coast of the Arabian Sea on one of two 10,000-sq. mile concessions held by the company.

B. Brandt Breedin, of South Carolina, is in charge of the operation. Drilling and a survey to determine the location for a second test will be directed from Karachi.

Hunt International was set up by Nelson B. Hunt, Dallas independent. He is the son of H. L. Hunt, president of Hunt Oil Co., Dallas. Concession agreements with the Pakistan Government were signed in Washington last September. The government has a 25 per cent interest in the venture *(The Oil and Gas Journal, September 19, 1955)*.

A rig is also being shipped to West Pakistan by Standard-Vacuum Oil Co., which holds two 5,000-sq. mile concessions in West Pakistan and a 10,000-sq. mile area in East Pakistan. Stanvac's rig will be set up around 150 miles east of Karachi and 10 miles north of Jhudo in the Province of Sind *(The Oil and Gas Journal, February 27, page 102)*.

New Maracaibo Line Planned

Cia. Shell de Venezuela is building a second underwater "Lapline" to transport its Lake Maracaibo production.

The new 20½-mile, 20-in. line will go into operation early in May and will double the capacity of the present 100,000-bbl. daily system. It will run under water from a platform on Block 1 to La Ensenada, approximately parallel to the 16-in. line which went into operation last year *(The Oil and Gas Journal, May 2, 1955, page 69)*.

The new line will merge at La Ensenada with the existing 28-mile, 24-in. overland section to Palmarejo. From Palmarejo, crude is shipped by pipeline to Cardon for refining and export.

Desert Show Found

Texaco tests may revive interest in Peruvian area

OIL shows found in a Sechura Desert wildcat may well rekindle a lagging interest in the once highly regarded area of Peru.

Texas Petroleum Co. (The Texas Co.) found the show in a well on its Peoco No. 7 tract in the extreme northwestern part of the Sechura Desert. The well later was suspended as noncommercial. It was drilled below 5,300 ft. and then plugged back to the 3,200-3,400-ft. interval for tests.

Company officials said only about 5 bbl. of 22°-gravity oil was swabbed in the tests. Texaco now is preparing to drill another test on its Peoco 3 tract adjoining Peoco 7 to the north and east.

The recent Texaco test is on a tract which adjoins a Sechura block held by Cia. Petrolera Peruana, owned by Peruvian nationals. It is the only company to obtain production in the Sechura since Peru opened the area for exploration in 1952.

Peruana has drilled two producers on its Mirador acreage. One of them tested about 500 bbl. of 38°-gravity crude and is just south of the producing Portachuelo pool of International Petroleum Co. (Jersey Standard).

Lean hunting . . . Exploration in Peru, especially in the easily accessible Sechura desert area, got under way little more than 2 years ago. At that time a new and more liberal oil legislation made the country's prospects attractive to foreign companies. A dozen companies obtained Sechura acreage.

A long succession of dry holes, at least 16 of them, took the bloom off the area. One by one the companies halted operations or shifted to eastern Peru.

Aden Refinery Expanding

British Petroleum Co., Ltd. will add a new 8,000-bbl. daily thermal reformer to the process units operated at the company's 120,000-bbl. daily refinery at Aden.

The reforming unit will be the first special process unit added to the refinery since it went on stream in July 1954. The refinery was built with two 60,000-bbl. daily crude distillation units, a 12,000-bbl. daily Platformer, and a 3,500-bbl. daily Autofiner.

The plant's cooling water system is now being expanded to increase the water supply by one-third. About 2,000,000 gal. of water an hour are circulated through the refining units.

First Cuban Gasser Indicated

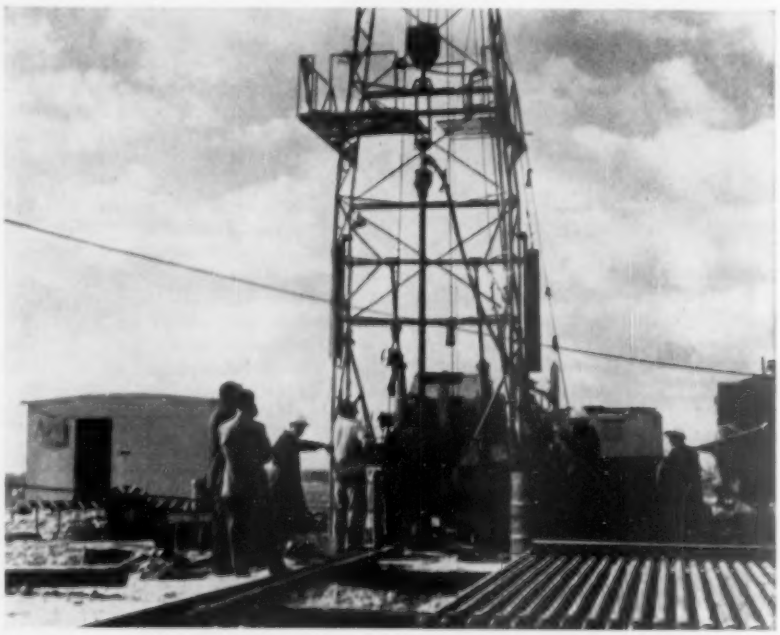
CUBA may have its first commercial gas well.

Cuban American Drilling & Exploration Co., Dallas, last week tested an estimated 5,000 M.c.f. of gas daily from 2,700 ft. at its 1 Cristales about 9 miles east of Jatibonico in Camaguey Province. Shut-in pressure was 1,000 psi.

The well was spudded November 1, 1955, and bottomed early this month at 8,344 ft. After setting 5½-in. casing at 2,898 ft. to shut off a water flow above the zone, about 30 ft. of a prospective 140-ft. section was perforated and acidized with 5,000 gal.

The operator was continuing tests before deciding whether to perforate more of the zone. Later tests may be made to evaluate an oil show at about 1,600 ft. The well previously tested three oil shows down to 2,000 ft., but they were noncommercial. Other shows were reported at 3,200 ft., 3,800 ft., 4,360 ft., and 4,650 ft. *(The Oil and Gas Journal, December 12, 1955, page 79, and January 16, page 89).* The well drilled through serpentine rocks, limestone, and black sandy shales.

The 1 Adelaide, Cuban American's first test on its million-acre concession in the Central basin, was abandoned as dry at 5,280 ft. in serpentine rocks. The indicated gas discovery is 9 miles southeast of the dry hole. The nearby Jatibonico field, discovered in May 1954, accounts for almost all of Cuba's oil production.



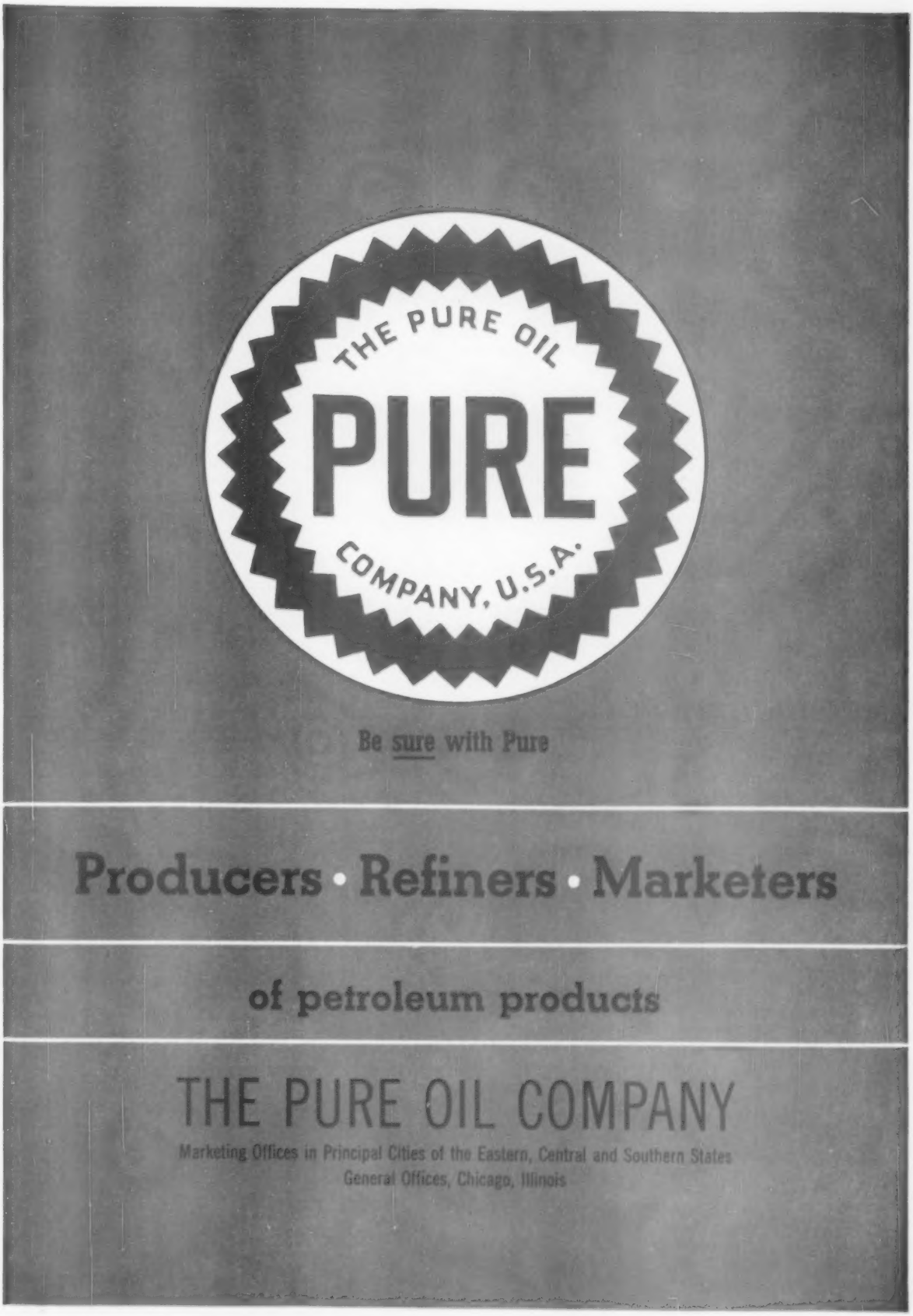
B.P. Steps Up Exploration on Malta

BRITISH PETROLEUM CO., LTD.'S, exploration program on Malta has entered the core-drilling stage. This truck-mounted rig is making a stratigraphic test at site No. 1 near Zabbar, about 3 miles inland from Valetta, capital of the Mediterranean island. Two locations have been staked.

B. P. is carrying on the exploration program through D'Arcy Exploration Co. Geophysical surveys have been completed over both Malta and a smaller neighboring island, Gozo. D'Arcy has established a paleontological laboratory at Valetta.

The 95-sq. mile island is a British colony, but last month its people voted overwhelmingly in a referendum to become integrated with Great Britain in a politically unique system.

Malta will organize and elect its own local government and send three representatives to the British Parliament. It has the effect of changing Malta's status from a colony to a constitutional part of Britain. The move is supported by Malta's present local government, but opposed by the Malta Archbishop of the Catholic Church because of the predominate protestant church in Britain. Malta's 321,000 people are nominally Catholic.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Something new in Middle East . . .

. . . Aramco Plans Water Flood

ARABIAN AMERICAN OIL CO. is preparing to conduct the first water flood ever undertaken in the Middle East at its big Abqaiq field in Saudi Arabia.

The initial operation planned by Aramco will be strictly a pilot injection program to obtain data to govern any future water injection program. The field has the first large gas-injection plant built in the Middle East expressly for the purpose of maintaining reservoir pressures *(The Oil and Gas Journal, March 22, 1954, page 118, and December 27, 1954, page 181).*

The big gas-injection plant, which returns 150,000 M.c.f. daily to the Arab zone below 6,000 ft., is in the southern portion of the 25-mile long field. The water injection will take place in the field's northern extremity.

First injection well . . . The first input well has already been drilled along with a companion water well.

While waiting for shipment of pumping equipment to start the project, Aramco engineers in Saudi Arabia connected the flowing water well to the injection well. The first water was injected by gravity flow last month. Pressures were inadequate to give Aramco the data it wants, however.

Two more injection wells with a water well for each will be drilled. The project is designed to inject 150,000 bbl. of water daily through three wells.

Field history . . . Abqaiq is an anticlinal structure covering nearly 90,000 acres. It is 25 miles long and about 6 miles wide. It was discovered in 1941 and since that time has produced over a billion barrels of 38°-gravity crude. Before the development of the big Ghawar field, Abqaiq was Aramco's biggest producer.

Free gas was first liberated in Abqaiq about the middle of 1949. But the pressure-maintenance program was not actually started until early 1954. The project cost $20 million. The two gas-injection wells are on the south crestal end of the structure.

The pilot water-injection program at the northern border of the field is designed to supplement the gas injection and aid in maintaining reservoir pressure.

International BRIEFS

Assam Oil Co., Ltd.'s, Nacholia well in northwestern India has reached the 13,060-ft. mark, nearly 400 ft. deeper than any well previously drilled in Asia. Production tests are under way. Located in Hugrijan prospecting license, the well is No. 12 in the company's current drilling program in the area *(The Oil and Gas Journal, March 19, page 136).*

Ste. Francaise des Petroles BP has placed an order for a fourth 33,000-ton tanker to join two now in service and one under construction. To be named the "Chaumont," the ship is due to be completed in 1958. The third tanker, "Cheverny," will be launched in June.

The biggest refinery column ever built in Britain has been shipped from G. A. Harvey & Co., London, to Venezuela for installation in a catalytic cracking unit at Cia. Shell de Venezuela's Cardon refinery. The tower is 147 ft. high and slightly more than 19 ft. in diameter.

The Belgium company, Cie. Financiere Belge des Petroles, S.A. (Petrofina), will start operations at its 6,500-bbl. daily Ruhrbau G.m.b.h. refinery near Cologne, in May. Petrofina acquired 75 per cent interest in the plant from Bayer interests last year. Opening of the plant will mark Petrofina's entry into marketing in West Germany.

Ste. Nationale des Petroles d'Acquitaine has started work on a gas purification plant at Lacq field in southern France.

Throughput of the plant will be about 35,000 M.c.f. daily. It also will produce small amounts of butane, propane, and natural gasoline, as well as 55,000 tons of sulfur per year.

The gas field, which underlies a small oil field, may cover 10,000 acres. The high pressure gas zone was discovered in 1951. Indications are that the pay zone, at about 11,500 ft., is at least 2,500 ft. thick.

Crews building National Iranian Oil Co.'s 573-mile, 10-in. products line have progressed 60 miles north of Ahwaz, Iran. This section is being built by Costain-John Brown-Williams Bros. under the Costan-Brown contract for 337 miles at the south part of the project from Ahwaz to Teheran.

I.P.C. Hunts Port

Company needs facilities to handle super tankers

BASRAH PETROLEUM CO., LTD., an affiliate of Iraq Petroleum Co., is considering building a crude pipeline from its southern Iraq fields across Kuwait to gain a deep-water loading port.

Shaikh Abdulla As-Salim Al Subah, ruler of Kuwait, has given the company permission to make an engineering survey for such a line. But no definite plans have been made. The I.P.C. affiliate is considering a line from Zubair and Rumaila fields to some point between the town of Kuwait and Mina Al-Ahmadi, Kuwait's loading terminal.

The two southern Iraq fields produced an average of 150,200 bbl. daily during 1955. This was a 57.4 per cent increase over 1954. The big increase can be credited to development of Zubair and bringing Rumaila into commercial production.

The bottleneck troubling Basrah Petroleum is not production, but shipping the oil it produces. The output of the fields is now moved by pipeline to Fao's tanker terminal on the Shatt-Al-Arab River. Fao is a shallow-water port and cannot load tankers larger than 15,000 tons.

Burma Wildcat Set

Burma Oil plans first test since before World War II

BURMA Oil Co. (1954), Ltd., will drill the first wildcat in Burma since before World War II.

The test is expected to begin this year after extensive preliminary work, including the construction of an approach road and a camp. The well, which may go to 10,000 ft., will be located near Ondwe village in Magwe District.

Ondwe structure is a well-developed dome. It is on the same axis of uplift as Yenangyaung field about 30 miles northwest. But the horizons which are productive in Yenangyaung are expected to be found at a much greater depth in the new test.

Gas and noncommercial shows of oil were found in six holes drilled on the structure between 1911 and 1927. The deepest reached 4,549 ft. Most of the tests were of sands from higher horizons than are productive elsewhere.

The well will be part of a program aimed at replenishing Burma's oil reserves. Before the war, the country produced about 21,000 bbl. daily.

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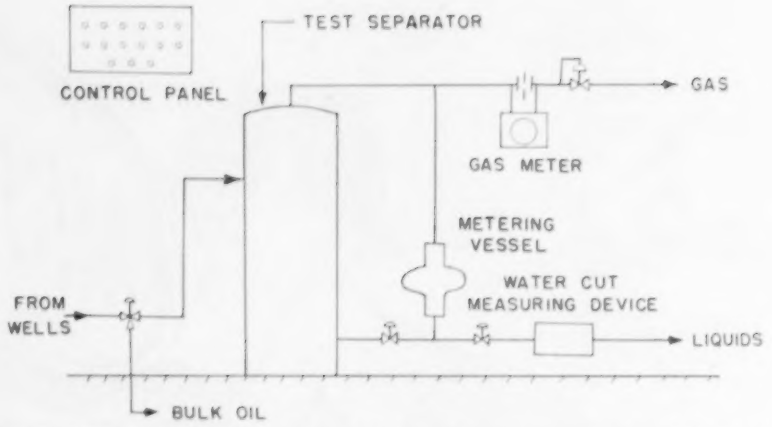


AUTOMATIC WELL-TESTING system which has performed very well in the field. Fig. 1.

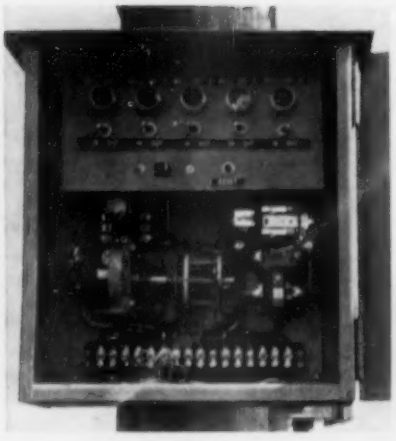


Fig. 2
ELECTRIC TANK SWITCHER is one of three automatic types now in use. It connects to . . .

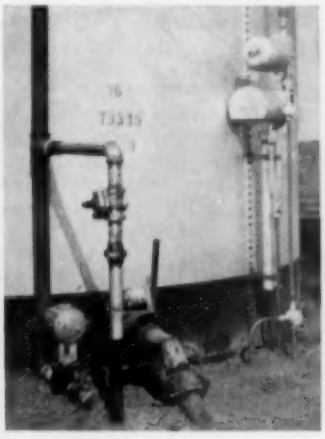


Fig. 3
TANK-FILLING VALVE, pipeline switch valve, and float switch, whose operation is monitored by . . .

Fig. 4
REMOTE TANK GAGE which receives signals from gage on tank. This system keeps track of 14 tanks in 5 batteries.

How Production Controls Work

. . . and what's needed for more efficiency

by L. M. Hubby
The Texas Co.

AUTOMATION of lease facilities has been under way for a number of years and many installations have been made. These applications are still in the development stage, however, and new developments are coming rapidly. Some of the problems they bring the industry are:

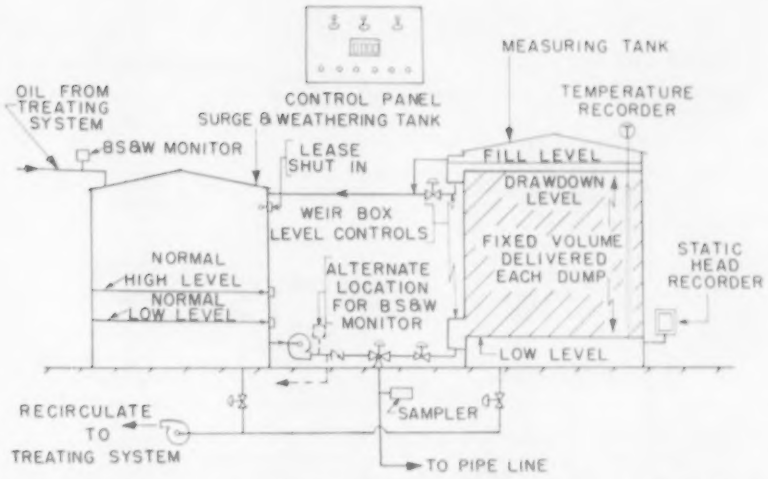
- Standardization of methods and equipment so new automatic installations can be made on a routine basis.
- Development of well controls so any type of well can be automatically produced efficiently.
- Improvement of parts of the well-test system such as manifold valves, gas-gathering systems and water-cut measuring devices so a really economical system can be built.
- Overcoming disadvantages of lease control systems to make them more self-sustaining.
- Realizing the need for a different operational setup for automatic leases.

The application of automatic devices to lease operation may be said to be in a development stage at present. Some applications are well established and

PRODUCING

are no longer regarded as "automatic controls," inasmuch as this classification is commonly thought of as meaning something new and different. Other applications are still in the test-tube stage. Problems vary from that of basic acceptance of the idea of automation in some areas to that of availability of equipment in other areas.

Work so far . . . Most automatic-control installations to date in lease operations have been installed as modifications of existing systems. The best applications are usually in new facilities where the cost of removing existing in-



AUTOMATIC CUSTODY TRANSFER may likely employ this single measuring tank system or one of the two systems shown in the following figures. Fig. 5.

stallations is eliminated and where adjustments in the work force are reduced to a minimum.

However, methods and equipment must be standardized before new installations can be undertaken on a routine basis. By "standardized" as used here, it is meant that in addition to having a workable and satisfactory system available, the field men must be sufficiently familiar with the system to plan its incorporation into the new installation, to operate it efficiently, and to maintain it after installation. It also means that the necessary equipment must be available on short notice and service obtainable when required.

In most areas, these requirements have not yet been met. Before they can be met, methods must be standardized so that custom-built costs are eliminated, delays in fabricating are reduced, and items can be stocked for quick delivery.

Much of the work which has been done so far toward automation of well testing, tank switching, and custody transfer has been in the nature of developmental work and will eventually provide a basis upon which standardization can be reached. A number of interesting and important developments have come about in this way, and some problems for which there is no economical solution at present have been recognized. Among these, the following items are worthy of note.

1. Control of Wells

In the control of stripper wells or other small producers having low bottom-hole pressures, the "pumpoff detector" appears to fill a definite need. This device determines when the well has pumped off and stops the pump machinery. At present, the use of this device is limited to electrified wells which can be automatically restarted after each off period. Worthwhile savings in power costs and equipment wear can be effected when this device is properly applied.

2. Measurement of Crude Oil

Metering vessels represent one of the important developments in the measurement of crude oil. These devices overcome most of the limitations of positive displacement meters where gassy crudes are to be measured or where slugs of gas may be present.

They are being used in well testing, in measurements for royalty payment before commingling at consolidated batteries, and in similar applications. They have established satisfactory records of operation in practically all instances and their use is spreading. First cost is greater than for positive-displacement meters but the payout comes through better acccuracy and lower maintenance costs.

THE AUTHOR

L. M. Hubby is petroleum engineer in charge of automation for The Texas Co. producing department. Hubby graduated from Texas A. and M. College in 1935 with a B.S. degree in electrical engineering. He joined The Texas Co. immediately after graduation, and spent 12 years in geophysical exploration. In 1947 he was transferred to The Texas Laboratories, Bellaire, Tex., where he conducted research on various production problems. In 1953 he was assigned to the staff of the chief engineer, producing department. Paper presented at 1956 Spring meeting of Southern District, Division of Production, American Petroleum Institute, San Antonio, under the original title "Automatic Production Controls."

3. Well Testing

Automatic well testing has received a great deal of attention and some very satisfactory systems have been developed. A typical system is shown diagramatically in Fig. 1.

Control panels used for switching wells and recording results are now available with hermetically sealed components and with results recorded, either as chart data or as printed figures, showing well number, date, production figures, and duration of test. Other components of well-test systems, such as manifold valves, gas-metering systems, and water-cut measuring devices, will require further development before a really economical well-test system can be built.

Most economical applications for automatic devices are those in which the device operates at frequent intervals, hence eliminates a great deal of manual attention, e.g., a separator dump valve or a well intermitter. Probably the most economical part of present well-test systems is the manifold valves which are required to operate only once during a well test and which then remain idle for as much as 10 to 30 days.

Gas metering need . . . As a further example of the need for development, present-day gas-metering systems are unable to handle the wide range of gas flows which are encountered in well testing unless a very elaborate system is used. In testing wells, it is not uncommon that the maximum gas-flow rate measured at the battery from the largest gas producer is 100 times the minimum rate from the smallest well, whereas the usual orifice meter has an accurate range of only about 3 to 1. Systems involving as many as four meter runs have been used to obtain the necessary range. Variable area meters, in which the differential pressure is held constant by varying the size of the orifice, can cover a 10:1 range, which is still far short of the requirement. A definite need exists in this regard and will no doubt eventually be met by equipment manufacturers.

Payouts on automatic well testing are usually based upon labor savings and upon the improved information obtained from such tests. Better equipment will give better information and a better payout.

Water-cut methods . . . The matter of water-cut determination in connection with well testing has been given a great deal of study and several promising arrangements have been worked out for this purpose. Probably the newest of these is the dielectric type which measures the dielectric constant of the

fluid and infers the water-cut from this measurement. This instrument offers a great promise because of the large difference between the dielectric constant for water and for oil.

However, the instrument has serious limitations at present in well-test service because it is adversely affected by free water, by variations in the size of the droplets in an emulsion, and to a lesser degree by gas, paraffin depositions and the rate of flow through the measuring element. When these factors are properly controlled, fairly accurate results can be obtained.

Samplers have long since been used for water-cut determination but have always been seriously limited in well-test service by the nonhomogeneous nature of the fluids being sampled. Recent developments in this field include improved sampling tubes to obtain a more representative cross-section of the fluid. They also use increased sampling rate to provide a statistically better sample. The theory behind this is that if enough samples are taken per unit volume, a representative sample can be obtained on the most nonhomogeneous fluid.

In practice, sampling rates as high as 20 samples per barrel have been tried. Results indicate that a more representative sample is obtained in this way when nonhomogeneous fluids are being sampled.

Heater treaters have been used for water and oil determination in automatic well testing but are expensive in comparison to other methods which measure the water-cut instead of actually separating the water and oil. One of the present needs of the industry is for a less expensive treating system designed for well testing.

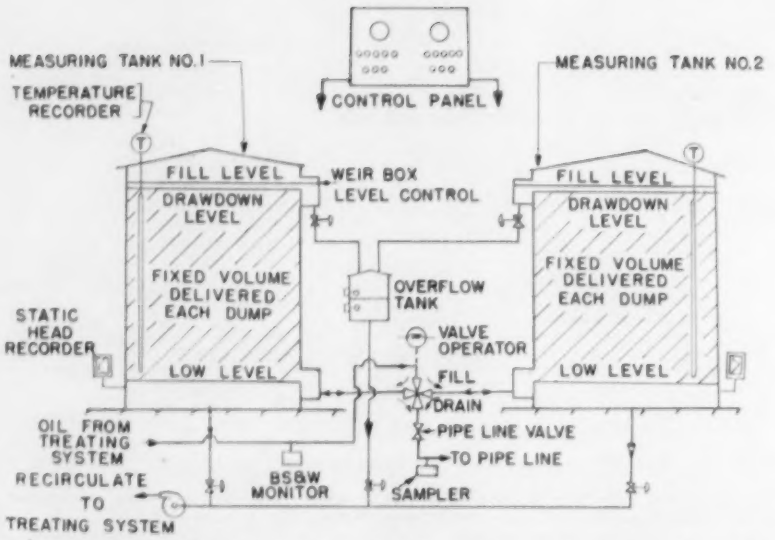
4. Tank Switching

Automatic tank switching has gained wide acceptance and is being installed in new installations in many areas. Three principal types are in use at present: the mechanical routing valve, the electrically powered system, and the pneumatically operated system.

A typical electric tank switcher is shown in Fig. 2, and its associated tank-filling valve, pipeline valve switch, and float switch are shown in Fig. 3.

Routing valves do not require external power for their operation but have not proved as flexible or as reliable in operation as the electric and pneumatic types. In cold climates, the pneumatic type suffers from freezing unless dry air or gas is used. Bottled dry nitrogen is being used for this purpose in some installations.

Electric tank-switching systems in common use are very good, but depend on commercial power for their operation. Failure of the electric power causes the tank-filling valves to close, so it is necessary to provide some means of stopping or containing the flow of oil from the wells in event of a power failure.



TWO MEASURING-TANK system for automatic custody transfer uses small overflow tank for leveling out delivered volumes. The tanks alternately fill and then discharge to pipeline. Fig. 6.

New electrical system . . . To overcome this undesirable characteristic of electrical systems, development work is currently being done on a low-voltage electrical system which derives its power from a thermopile generator which burns lease gas. These generators have no moving parts and require only a small flame for operation. Such a system would be applicable to many tank batteries which do not have commercial power available.

Payouts on automatic tank switching are generally based on labor savings and the better use of tank storage volume. These savings are frequently much better than might be anticipated because the pumper does not have to be at the battery at a particular time to switch tanks, hence can schedule and perform his work more efficiently.

5. Remote Tank Gaging

Remote tank gaging, although not automatic, is usually classified as such because it is new and different in lease operation. Fig. 4 shows a remote gaging panel which enables the pumper to keep track of 14 tanks in 5 batteries which are located at distances up to several miles from the gaging point. The tank gage and transmitter which send information to the gaging panel are shown in the right-hand part of Fig. 3. This system, in conjunction with automatic tank switching, effectively reduces the pumper's time and mileage required to operate each battery.

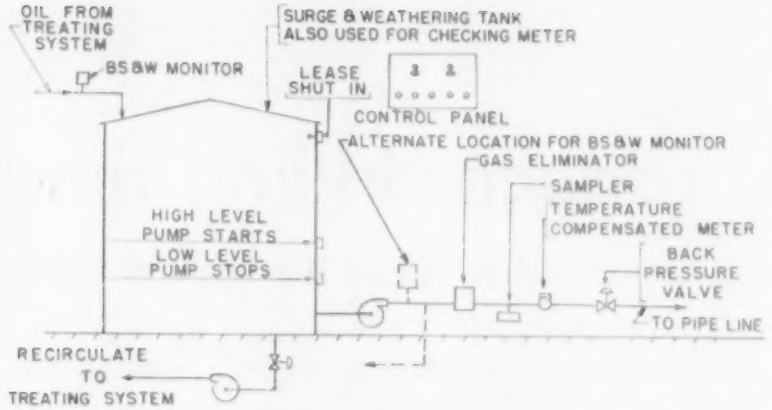
6. Custody Transfer

Automatic custody transfer represents a new philosophy in lease operation, based on a relatively continuous delivery of the produced oil to the pipeline outlet. This is opposed to the conventional method of accumulating the produced oil in lease tankage and periodically delivering the oil manually to the pipeline. As a result, a worthwhile reduction in the number and size of lease storage tanks can be made. In many instances, the savings in tankage will pay for the automatic installation.

Labor savings are also effected because the pumper is relieved of the work of topping out and switching tanks, recirculating tank bottoms, etc.

A further advantage is the possibility of equipping a lease for fully automatic operation from the well to the pipeline outlet, including safeguards which will monitor the operation and shut in the entire lease in case of trouble. This greatly reduces manual supervision and enables use of numerous minor automatic devices which cannot be justified as long as the pumper must visit the battery at frequent intervals and can do these minor jobs while he is there. By eliminating these frequent trips, a payout on these various minor devices can be obtained.

Where best used . . . The method is particularly applicable to consolidated batteries in unitized secondary-recovery operations which are daily becoming more numerous. In these operations, production usually increases as the flood progresses, requiring the addition of tankage to handle the larger volume of oil. In this situation, automatic



DISPLACEMENT METER system for measuring oil to pipeline uses but a single surge tank. Strainers, air and gas eliminators and some form of flow control are necessary safeguards for this system. Fig. 7.

custody transfer can usually be installed with less expenditure than would be required for conventional tankage.

Developments in automatic custody transfer are occuring rather rapidly at present because of the widespread attention and study being given to the problem by various operators and by equipment suppliers. A number of such batteries are in operation at present on a shakedown basis to establish satisfactory operation before starting unattended automatic operation. Many others are in the planning stage.

Planning problems . . . The principal problems involved in this type of operation include: (1) the provision of a treating system which will provide merchantable oil to the automatic custody transfer system so that rejected oil is held to a minimum; (2) the accurate measurement of the volume, temperature, gravity, and b.s. and w. of the oil delivered; (3) the reliable recording of these measurements; (4) the rejection and recirculation of nonmerchantable oil; (5) protection of the installation against environmental conditions such as cold weather, corrosive conditions, paraffin deposition, tampering, etc., to insure reliable operation under all conditions; (6) the provision of manual controls for emergency or special operation, arranged in such a way that their use will not result in false recording or improper operation of the system when restored to automatic control; (7) provision for scheduling deliveries in accordance with lease allowables and pipeline batching requirements where this is necessary; (8) provision for manually checking the operation of the unit with commonly available tools; (9) sufficient flexibility to meet changing conditions such as the normal changes which occur during the life of a well, seasonal changes, changes of allowables, etc.; and (10) provision of an over-all system which is adequate to perform the required operations and yet simple enough to be feasible from the economic and operational viewpoint.

Principal methods . . . Within the framework of the foregoing requirements, many arrangements are possible. However, on the basis of experience, it appears that three arrangements may emerge as the principal types of automatic custody transfer battery. These are a single measuring tank arranged to deliver a fixed volume for each delivery (Fig. 5), a system using two measuring tanks in which one tank fills while the other drains, with each tank delivery a fixed volume (Fig. 6), and a system using a surge tank to accumulate the production and a positive displacement meter to periodically run the accumulated oil to the pipeline (Fig. 7).

In the tank systems, the fixed volume delivered is determined by overflow weirs set at high and low levels in the measuring tank. These devices appear to offer the best long-term accuracy and trouble-free operations available at present and have met with ready acceptance in most quarters because they offer an accuracy which approaches the accuracy of the tank calibration itself.

In the system using a meter to measure volumes, a number of safeguards are necessary to assure the best results. These include strainers, air and gas eliminators, a back-pressure valve to maintain a positive head on the meter, and some form of flow control to keep the flow rate within the accurate range of the meter. In addition, some form of proving device must be provided for regularly checking the accuracy of the meter. A great deal more reluctance has been shown in accepting the meter system than the tank systems.

Changes to be made . . . Automatic-custody-transfer batteries are, by their very nature, more complicated than standard manually operated batteries. They require less manpower to operate but are more complicated when repairs are needed. This fact will undoubtedly result in a number of changes in the operational setup now employed at manual batteries. A regular program of maintenance will be required; one skilled worker may eventually replace several less skilled; and a fail-safe shutdown system will probably replace the constant manual surveillance now used.

Pipeline companies have shown a keen interest in automatic custody transfer because they see potential savings in gagers' time and better scheduling of runs for more efficient use of their lines. They recognize such design problems as: (1) provision of adequate weathering time prior to measurement, to reduce evaporative losses in their system; (2) adequate safeguards against tank-bottom build-ups; and (3) rejection of nonmerchantable oil. These requirements are adequately met by existing designs and there does not appear to be a serious problem here.

Rules to be met . . . Representatives of state regulatory bodies, generally speaking, have taken a favorable view of the automatic-custody-transfer method when approached informally, but have pointed out several requirements that must be met before such operations can be inaugurated on a regular basis. Among these are: (1) some provision must be made to limit monthly deliveries to the amount of the allowable; (2) a "shakedown" period must be satisfactorily completed before final approval can be given; and (3) some states will require public hearings and formal approval because the method of delivery conflicts with existing regulations.

In recent months, several oil-field suppliers have set up active departments to handle equipment and problems involved in lease automation and new items of equipment are appearing on the market daily in answer to the needs of the industry. Also, several companies are now prepared to make field installations on a turnkey basis with suitable performace guarantee, free service for a shakedown period, and service thereafter at established rates. This approach will no doubt accelerate the application of automatic controls.

4 Ways . . .

to reduce drilling time

. . . as practiced in Texas' Big Mineral Field

31 per cent . . . by increasing hole-deflection tolerances from 3° to 1° per 1,000 ft. of depth.

44 per cent . . . by using oversized drill collars with conventional-type bits and increased hole-deflection tolerances.

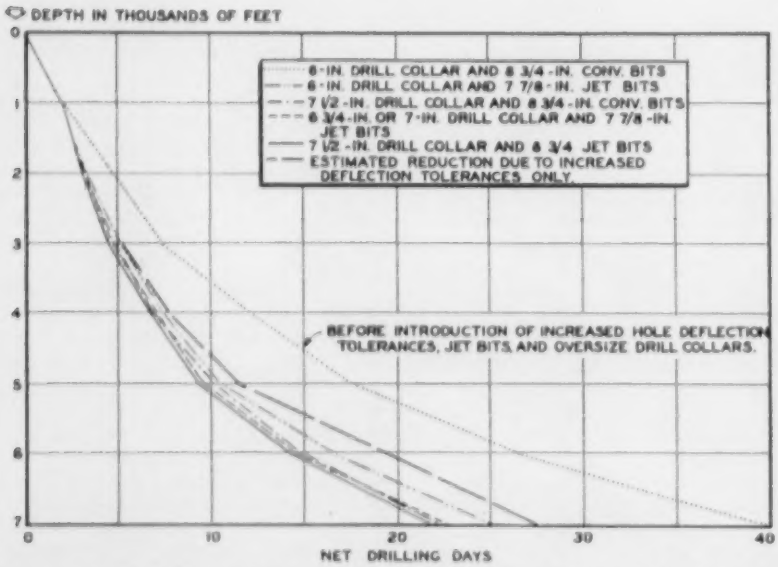
37 per cent . . . by using jet bits with conventional-sized drill collars and increased hole-deflection tolerances.

45 per cent . . . by a combined technique, using increased hole-deflection tolerances, 8¾-in. jet vits, and 7½-in. o.d. drill collars.

by J. S. Lowe
Shell Oil Co.

INCREASED hole-deflection tolerances, oversized drill collars, and jet bits reduced drilling time substantially in Big Mineral field, Grayson County, Texas. Drilling time on a typical 7,000-ft. well was cut from 39.5 to 23 days, or 41 per cent (Fig. 1). It is significant that the major portion of this reduction was accomplished early in the field's drilling program, and affected the drilling of some 50 subsequent wells.

Big Mineral field is a moderately faulted, elongated, anticlinal structure containing five producing horizons of Pennsylvanian age ranging in depth from 3,400 to 7,800 ft. (Fig. 2). A deeper horizon of Ordovician age is also productive in certain sections of the field. Formations which must be drilled consist primarily of medium-hard sandstones with interbedded streaks of shale. They are relatively flat-lying to a depth of approximately 5,500 ft., below which the dips vary from about 12° near the structure's crest to more than 55° on the flanks. These steeply dipping formations create crooked-hole drilling problems as a result of the bore hole tending to drift updip. All formations are competent, hole conditions are good, and subsurface pressures are normal.


DEPTH IN THOUSANDS OF FEET
0
1
2
3
4
5
6
7
6-IN. DRILL COLLAR AND 8 3/4-IN. CONV. BITS
6-IN. DRILL COLLAR AND 7 7/8-IN. JET BITS
7 1/2-IN. DRILL COLLAR AND 8 3/4-IN. CONV. BITS
8 3/4-IN. OR 7-IN. DRILL COLLAR AND 7 7/8-IN. JET BITS
7 1/2-IN. DRILL COLLAR AND 8 3/4 JET BITS
ESTIMATED REDUCTION DUE TO INCREASED DEFLECTION TOLERANCES ONLY.
BEFORE INTRODUCTION OF INCREASED HOLE DEFLECTION TOLERANCES, JET BITS AND OVERSIZE DRILL COLLARS.
0
10
20
30
40
NET DRILLING DAYS

DRILLING CURVES show how the various factors served to reduce number of days required to drill wells at Big Mineral field. Revised drilling program cut 41 per cent by increasing hole tolerances, using jet bits and oversized drill collars. Fig. 1.

Conventional North Texas drilling methods, i.e., 6-in. o.d. drill collars, 8¾-in. regular-type bits, and a maximum hole-deflection tolerance of 3°, were employed during the drilling of the field's first 10 wells. These wells were drilled in a noncontinuous program over a period of 2 years beginning in April 1951. In general, bit weights were restricted because of the 3° deflection tolerance, resulting in low penetration rates, poor bit life, and consequent high drilling costs.

New drilling program . . . Following a review of available drilling data and a conference with the two contractors then in the field, it was apparent that a material reduction in drilling time could not be expected on subsequent wells unless drilling practices were modified. Following this conference, therefore, the following changes were introduced: Hole-deflection tolerances were increased to 1° per 1,000 ft. of depth,[2] one of the two contractors com-

BIG MINERAL lies in northwestern Grayson County. Subsurface formations are primarily medium-hard sandstones with interbedded streaks of shale. Fig. 2.

menced a 7⅞-in. jet-bit program using 6-in. o.d. drill collars, and the other changed to 7½-in. o.d. drill collars[1 2 3] but continued to use 8¾-in. conventional bits. Each of these two contractors drilled approximately six wells using these techniques with encouraging results. Drilling time to 7,000 ft., as shown in Fig. 1, was reduced 37 per cent by the use of jet bits and increased hole-deflection tolerances, and was reduced 44 per cent by the use of oversized drill collars and increased hole-deflection tolerances.

Since each of these two programs, coupled with the increased hole-deflection tolerances, was successful in reducing drilling time, it appeared that a further reduction could be accomplished by combining both jet bits and oversized drill collars. Accordingly, the 6-in. o.d. drill collars were replaced with 6¾-in. o.d. collars, and the 8¾-in. conventional bits with 8¾-in. jet bits. During this stage of the drilling program, another rig entered the field using 7⅞-in. jet bits with 7-in. o.d. drill collars. These combined techniques were used throughout the remaining drilling program.

When compared to the average drilling time using conventional North Texas drilling methods, the use of these techniques resulted in an over-all average reduction in field drilling time of 41 per cent.

The various drilling practices employed in Big Mineral field were therefore as follows:

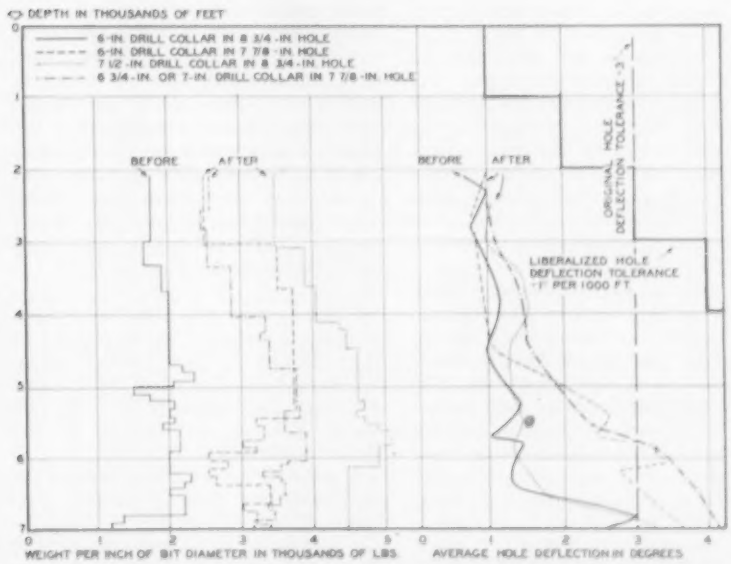
First stage of drilling program—8¾-in. conventional bits; 6-in. o.d. drill collars; deflection limit, 3°.

Second stage of drilling program—8¾-in. conventional bits; 7½-in. o.d. drill collars; deflection limit, 1° per 1,000 ft. of depth. 7⅞-in. jet bits; 6-in. o.d. drill collars; deflection limit, 1° per 1,000 ft. of depth.

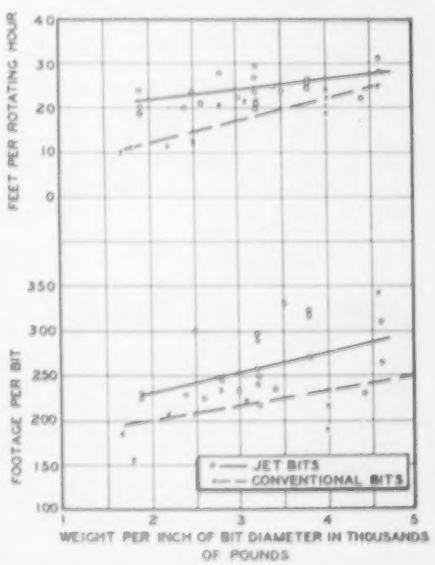
Third stage of drilling program—8¾-in. jet bits, 7½-in. o.d. drill collars; deflection limit, 1° per 1,000 ft. of depth. 7⅞-in. jet bits; 6¾-in. or 7-in. o.d. drill collars; deflection limit, 1° per 1,000 ft. of depth.

Rotary speeds, bit types, and mud properties were essentially equivalent on all wells. In all data relative to different bit sizes, weight per inch of bit diameter has been used as the basis of comparison, in line with the idea that weight per inch of bit diameter has a direct relation with penetration rate. Data and results reported are for 42 comparable wells.

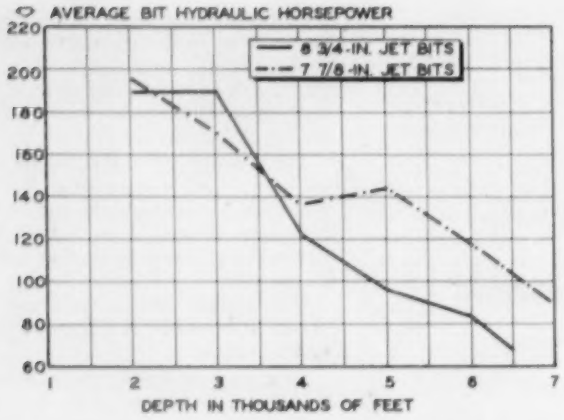
Increased hole-deflection tolerances . . . Fig. 1, comparing techniques and net


DEPTH IN THOUSANDS OF FEET
6-IN. DRILL COLLAR IN 8 3/4-IN. HOLE
6-IN. DRILL COLLAR IN 7 7/8-IN. HOLE
7 1/2-IN. DRILL COLLAR IN 8 3/4-IN. HOLE
6 3/4-IN. OR 7-IN. DRILL COLLAR IN 7 7/8-IN. HOLE
BEFORE
AFTER
BEFORE
AFTER
ORIGINAL HOLE DEFLECTION TOLERANCE -3°
LIBERALIZED HOLE DEFLECTION TOLERANCE -1° PER 1000 FT.
WEIGHT PER INCH OF BIT DIAMETER IN THOUSANDS OF LBS.
AVERAGE HOLE DEFLECTION IN DEGREES

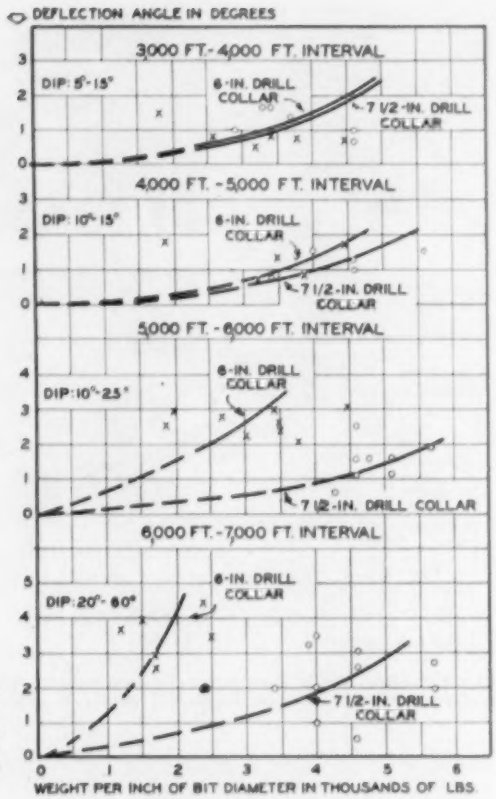
WHEN THE OPERATOR revised the hole-deflection tolerances, contractors drilled the wells faster because they could carry greater weights on the bit. Fig. 3.


FEET PER ROTATING HOUR
FOOTAGE PER BIT
JET BITS
CONVENTIONAL BITS
WEIGHT PER INCH OF BIT DIAMETER IN THOUSANDS OF POUNDS

JET BITS performed better than conventional bits at shallow depths. Fig. 4.



BIT HYDRAULIC horsepower decreased considerably with depth and probably explains the poorer performance of jet bits below about 5,500 ft. Fig. 5.



USE OF LARGE drill collars keeps hole deviation to a minimum even while using high bit weights. The advantages of the larger drill collars increase with depth. Fig. 6.

drilling days, shows an estimated reduction in drilling time of 12 days, or 31 per cent, which resulted solely from increased hole-deflection tolerances. The exact reduction is undeterminable since hole-deflection tolerances were changed simultaneously with the introduction of jet bits and oversized drill collars. The increased tolerance was by far the largest contributing factor in the over-all time reduction.

In estimating the reduction that might have been accomplished by increased hole-deflection tolerances alone, four wells drilled with 6-in. o.d. drill collars before increased deflection tolerances were compared with five wells drilled with 6-in. o.d. drill collars after hole deflections were liberalized. Drilling time under the increased hole-deflection tolerances, but without jet bits or oversized drill collars, was estimated with the aid of the data shown in Fig. 4 and similar graphs for other intervals.

Fig. 3 shows that hole deflections were not materially increased while using high bit weights until the more dipping formations were encountered at about 5,500 ft. It can, therefore, be concluded that the increased deflection tolerances only "encouraged" the use of more weight on bit above 5,500 ft., but was an actual aid while drilling the steeply dipping formation below this depth.

Oversized drill collars . . . As shown in Fig. 1, drilling time to 7,000 ft. was reduced from 39.5 days to 22 days by the use of 7½-in. o.d. drill collars and increased hole-deflection tolerances. Of this 17.5-day reduction, an estimated 5½ days were attributable solely to the increased collar size. In like manner, when drill-collar size was increased from 6 to 6¾ or 7-in. o.d., drilling time to 7,000 ft. was reduced from 25 to 22.5 days, or 2½ days.

Fig. 3 shows the hole deflections resulting when different bit weights were applied using various sizes of drill collars in Big Mineral field. These curves show that relatively low hole deflections were experienced in the deeper more steeply dipping formations while using the 7½-in. o.d. drill collars, even though higher weights were applied to the bits.

This characteristic of larger collars, i.e., maintaining relatively low hole deflections even while using high bit weights, is also shown by Fig. 6. In this figure, 6-in. and 7½-in. o.d. drill collars are compared to hole deflections at various bit weights in four 1,000-ft. intervals. Within these broad intervals, the data shown were prepared by selecting necessarily short intervals; these varied in thickness from 100 to 200 ft., and were drilled at a constant hole deflection. This hole deflection was then plotted against the average weight used while drilling this particular interval. Although the data, when plotted, had narrow limits, it appears reasonable to believe that deflection and weight vary generally as shown by these curves.

It is readily apparent from Fig. 6 that the advantages of the 7½-in. o.d. drill collars as compared to the smaller collar increased with depth. This appears logical since formation dips also increase with depth in Big Mineral field.

It should be noted that drill collars larger than those which could be washed over were used in Big Mineral field. It is believed that the use of oil-emulsion mud minimized the risk associated with using this technique since collars were stuck in only two wells. The resulting fishing jobs were simplified since 10¾-in. surface casing permitted reaming down to the collars.

Jet bits . . . Jet bits generally outperformed conventional bits to a depth of approximately 5,500 ft., both in penetration rate and in footage per bit. The maximum estimated savings in rig time which could be attributed to jet bits alone amounted to 2½ days. Fig. 4 is a graphical performance comparison for the interval 3,000 to 4,000 ft. This figure shows jet bits to be about 33 per cent better in penetration rate and about 18 per cent better in footage per bit in this interval. A review of

THE AUTHOR

James S. Lowe is mechanical engineer, division, for Shell Oil Co. in Wichita Falls, Tex. He has been with Shell for the past 4½ years and has been closely associated with drilling operations in Big Mineral field. Before his assignment to Wichita Falls he worked for Shell in Great Bend, Kans., and Oklahoma City. He graduated from University of Oklahoma with a degree in mechanical engineering in 1951.

similar graphs for the other intervals to 7,000 ft. indicated that the advantage of jet bits decreased with depth and that conventional bits were more economical below about 5,500 ft. It should be noted from Fig. 5 that bit hydraulic horsepower[4] decreased with depth because of equipment limitations. This decrease in bit hydraulic horsepower probably explains the poor jet-bit performance at the deeper depths. It is interesting to note from Fig. 4 that jet bits compared favorably with conventional bits even though less weight was carried on the jet bits. Therefore, jet bits, by drilling faster and lasting longer with a given weight on bit, appear to have application in crooked-hole areas assuming that adequate bit hydraulic horsepower is available.

Combined technique . . . From what has been stated earlier about increased hole-deflection tolerances, jet bits, and oversized drill collars, it would appear logical to assume that, if all three of these techniques were combined in a single well, drilling time would be reduced to a minimum. Reference to Fig. 1 which compares the average drilling time and technique, shows that the maximum reduction in time was accomplished by using jet bits, oversized drill collars, and the increased hole-deflection tolerances. Moreover, it shows that the minimum drilling time was achieved using 8¾-in. jet bits and 7½-in. o.d. drill collars. It is considered likely that a further reduction would have been effected with increased bit hydraulic horsepower in the deeper intervals.

Conclusions . . . A review of the overall drilling data acquired while drilling some 50 wells in Big Mineral field, using the techniques discussed in this report, permits the following conclusions:

1. Drilling time was reduced an estimated 31 per cent by increasing hole-deflection tolerances from 3° to 1° per 1,000 ft. of depth.

2. Oversized drill collars, when used with conventional-type bits and increased hole deflection tolerances, reduced drilling time by about 44 per cent.

3. Jet bits, when used with conventional-sized drill collars and increased hole-deflection tolerances, reduced drilling time by about 37 per cent.

4. A combined technique, using increased hole-deflection tolerances, 8¾-in. jet bits, and 7½-in. o.d. drill collars, reduced drilling time by about 45 per cent.

It is believed, therefore, that a reduction in drilling time could be accomplished in any field similar to Big Mineral by using any, or all, of the four techniques discussed.

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ELEMENTS OF FIELD PROCESSING—12

Centrifugal Mist Extractors

. . . *Principles and operation*

by Dr. John M. Campbell

IN previous parts of this series, it has been noted that centrifugal force has been an integral part of separation processes. The standard oil and gas separator has a tangential inlet, for example, that utilizes centrifugal force to separate out the larger droplets.

The same principle is used in some mist-extractor elements except that higher velocities are needed in order to separate the smaller droplets. Equations 6 and 7, Part 9, show that the velocity needed for separation is a function of the particle diameter, particle and gas density, and the gas viscosity. Equation 7 was written as:

$$D_p = \left[\frac{9\mu s}{\pi V_a N (\rho_L - \rho_G)} \right]^{1/2}$$

where:

D_p = diameter of particle that would be collected, ft. or cm.
μ = gas viscosity, cp.
s = radial path of particle, ft. or cm.
V_a = average velocity of gas, cm. per sec. or ft. per sec.
N = effective number of turns made by gas stream in the cyclone, dimensionless.
ρ_L = density of particle, g. per cc. or lb. per cu. ft.
ρ_G = density of gas, g. per cc. or lb. per cu. ft.

Velocity important . . . With a given system it is obvious that the size of particle collected is inversely proportional to the square root of the velocity. Consequently, the success of a cyclonic mist extractor is dependent on the velocity attained. Furthermore, the velocity needed to separate a given size of particle must increase as the density of the particle becomes less. In addition to producing the necessary velocity, the mist extractor must provide an efficient means of collecting and removing the particles collected in order to prevent reentrainment.

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Need direction change . . . One common type of equipment is often called a "steam separator" since it has been widely used to separate condensate and pipe scale in steam systems. It is normally a relatively small vessel which imparts a high velocity to the incoming gas and then makes the gas change direction radically to prevent reentrainment. In general the simple type shown will separate particles 40μ and larger very efficiently.

Another type uses the same principle but, in addition, forces the gas to pass through a labyrinth which introduces impingement effects and forces the gas to change direction a number of times. This is in reality a combination type and is relatively efficient. The general performance characteristics are the same as efficient mist extractors of other types. Some, however, are complex and relatively expensive.

Cyclone becoming popular . . . In the last several years the use of a multicyclone extractor has become more widespread. A schematic view of this is shown in Fig. 1. This may be mounted in the top of a regular vessel or in a small separate scrubber.

This unit, marketed under the trade name of Aerotec, imparts a centrifugal force to the gas entering at A. It spirals downward and at vortex B reverses direction. Clean gas emerges at C while dust and distillates thrown to

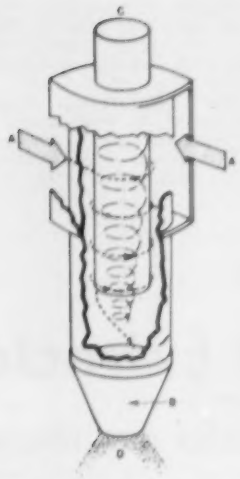

Fig. 1—Action of Aerotec tube.

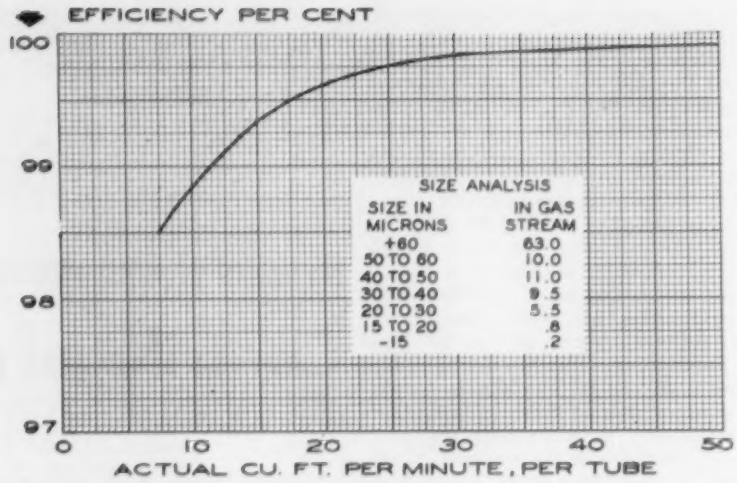

Fig. 2—Over-all collection efficiency vs. cubic feet per minute per tube for pipeline dust of size analysis as shown.

the wall by centrifugal force are discharged at D.

By using a number of such tubes in parallel, a high velocity is imparted to the gas which, by the above equation, would indicate that small particles could be separated. For a given flow rate, therefore, the number and size of tubes used depend on the relative density of the particles and the gas. With water, for example, less centrifugal force; i.e., more tubes, are used than with distillate.

The equation would also indicate that the separation would become more difficult as the gas density increased. This probably accounts for the lower efficiency exhibited by all centrifugal devices at elevated pressures. However, all other devices have this same failing. This common fault points out that increasing pressures give a corresponding increase in the extraction problem.

Pressure drop limited . . . Fig. 2 shows the over-all collection efficiency shown by the manufacturer when processing pipeline dust of the size shown. Similar data show that the relationship between flow rate and pressure drop may be expressed by the following equation:

$$F = K (\Delta P)^{0.5} \qquad (1)$$

where:

F = cu. ft. per minute per tube.
ΔP = pressure drop, psi.
K = function of pressure.

Typical values of K are:

Pressure (psig.)	K
20	22
50	14
100	10.5
500	5.4
700	4.2

This equation, together with Fig. 2, shows that the collection efficiency is a direct function of the pressure drop. The only practical limitation to the flow rate is therefore the allowable pressure drop.

Handles solids and liquids . . . The multicyclone separator has been used effectively in the separation of dusts as well as liquid particles. It is substantially self-cleaning and can handle relatively large quantities or both. In some cases an impingement-type element has been effectively used ahead of such a unit. The first acts as an agglomeration agent for the smaller particles which may then be separated in the centrifugal unit.

The chief disadvantage of any centrifugal unit is that the efficiency falls off rapidly as the velocity decreases below a certain point. Therefore, when widely varying loads are encountered this type of unit shows decreased advantage. However, if a higher pressure drop is tolerable the unit may be designed for the lowest flow rate anticipated since it gives efficient separation at greater than rated capacity.

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BOOKS

ATLAS OF PALEOGEOGRAPHIC MAPS OF NORTH AMERICA, by Charles Schuchert. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 177 pp., $4.75.

This useful publication contains 84 paleogeographic maps of the North American Continent, representing the greater part of Schuchert's efforts to chronicle the stratigraphy of North America in graphic form. In 1904 this eminent geologist taught his first class in Stratigraphy of North America at Yale. It was then that he hit upon the idea of constructing paleogeographic maps as the best way to illustrate geologic history to his students.

The idea caught on, and he devoted a great deal of his life to preparing additional maps for publication. By 1910, he had published 49 maps and his ultimate goal was to prepare at least 100 and possibly 125.

It was Schuchert's intention to publish the full set of his detailed maps, but during the years the time for publication never seemed to arrive. After retirement, he began a plan for four volumes on the Stratigraphy of North America, to be followed by an atlas containing these 125 maps. The first volume was published in 1935 and the second posthumously in 1943. The third and fourth have never appeared for they were incomplete at the time of Schuchert's death in 1942.

This atlas is the work of Schuchert's secretary, assisted by Carl O. Dunbar. They selected the best of Schuchert's original maps and arranged for this publication. It is a very valuable addition to the geologic literature and should find a place in every oil finder's library. The volume is spiral bound with a leatherette cover, and the printing is excellent. Individual maps can be removed for detailed study.

PRINCIPLES OF CHEMICAL ENGINEERING THERMODYNAMICS, by Ernest D. Wilson and Harold C. Ries. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 36. 370 pp., $7.50.

This book, while intended primarily as a text for an undergraduate course in thermodynamics for chemical engineers, contains much for the practicing engineer as well. The book uses methods of presentation of the subject which have been found to be most effective by the authors in 18 years of teaching.

The authors' stated objective is to make their exposition of the subject simple and easily understood, yet they have not sacrificed accuracy of treatment or omitted important subjects.

The subject is developed as a tool and a method of approach to the solution of industrial problems. Fundamental principles are presented first and then these principles are used in the solution of problems encountered in industry.

SKIDDING A BIG RIG

• Quickly
• Safely
• Economically

HERE, in picture sequence, the Journal dissects the technique of skidding a big rig from one location to another.

In the current period of high drilling costs, it is vital to the contractor that he get his rig off an old hole and onto a new location quickly.

Where moving distances aren't great, skidding is a time-proved method of getting there fast. Rig-builders, recognizing this, are manufacturing many of the large new rigs so that they are highly adaptable for skidding.

Such a rig is Durham Drilling Co.'s new No. 4, which in the picture sequence was moved half a mile to a new location in the flatlands near Lovington, N. M., in just 8 hours.

As in most cases, this skidding job was handled by a skidding contractor or rig mover who furnishes the skid beams, jacks, dozers, etc. Contractor on this project was Rumbaugh, Inc., Odessa, Tex., one of the oldest in the business who has been moving rigs since Spindletop in 1902.

The Durham rig is an Ideco Super 7-11 model, the first of its kind to be manufactured and sold. It was designed for flexibility—to be operated as economically at 8,000 ft. as on deep 15,000-ft. tests—and for quick moving.

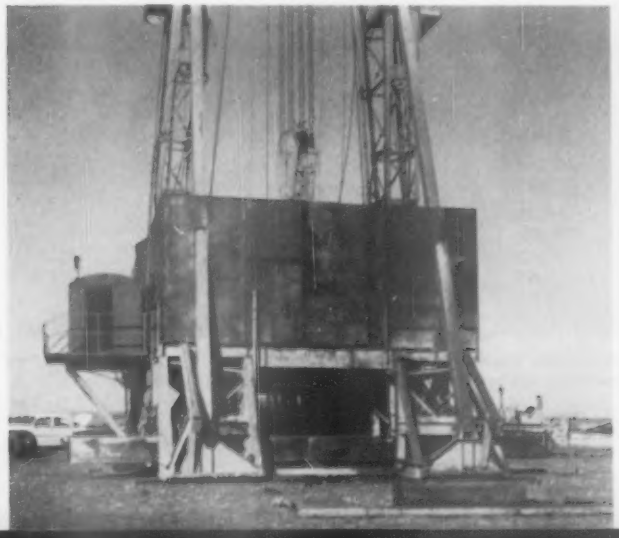
Only major items of equipment which must be disconnected and moved separately are the two Ideco Mud-Master 600-hp., 30,000-lb. mud pumps.

The 8-hour skid job pictured here, though not necessarily a record move, is significant in that it shows how big new power rigs designed for fast moving in the operating position can almost match the mobility of the lighter wheeled equipment.

(More on next two pages)

1 DURHAM DRILLING CO.'S new Ideco Super 7-11 rig has completed a 13,000-ft. test and is ready to go to next location.

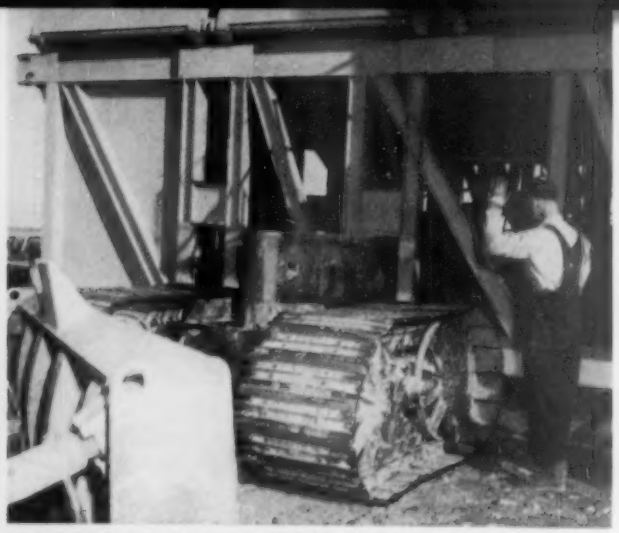
2 TWO 40-FT. box steel skid beams are inserted through specially designed windows to carry entire weight of rig in easy balance—one under engine base, one at front edge of working floor. Beams are furnished by skidding contractor.



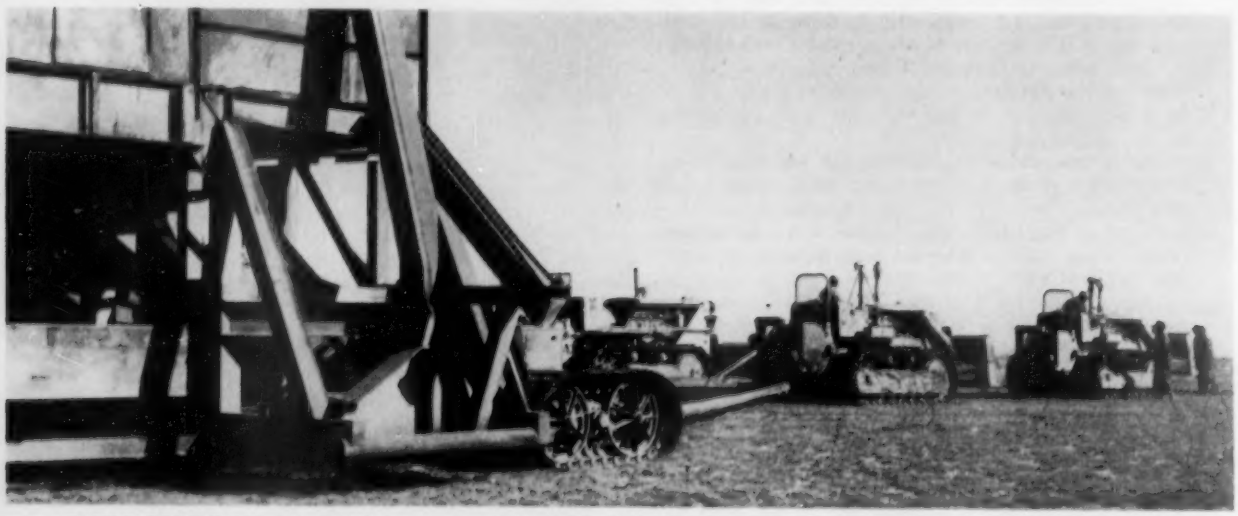
3 HYDRAULIC JACKS, six sets to each skid beam, go into position under the skid beams—four sets in the tunnel between the substructure boxes, one set at either end of beam outside substructure.

Skidding a Big Rig . . .

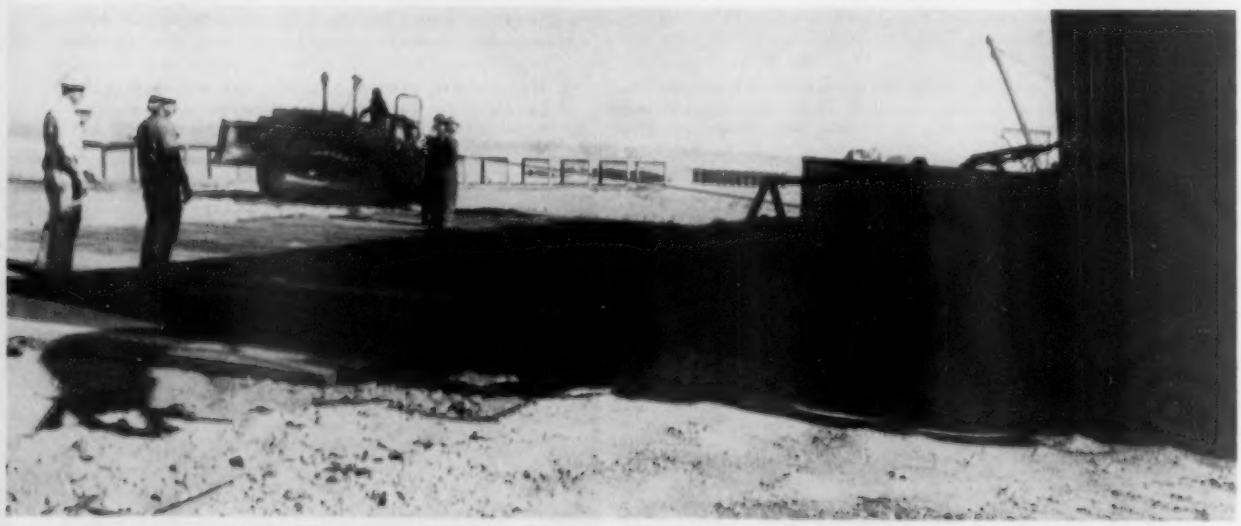
4 BULLDOZER GETS SET to nuzzle Athey wagons into position under skid beams. Continuous tracks on wagons provide large bearing surface needed on open ground.



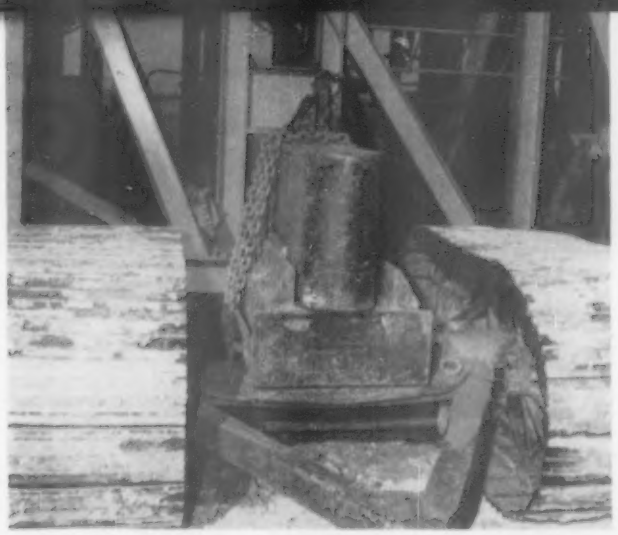
5 ATHEY WAGONS are positioned under the end of each skid beam. Four wagons will support the full load of the rig.



8 DOZERS LINE UP—the two D7's to pull on the 19 drawbar, the D8 on a winch line attached directly to skid beam under the engine base which is heaviest part of rig. The latter's function is mainly to compensate for tendency of rig's heavy side to lag or twist.



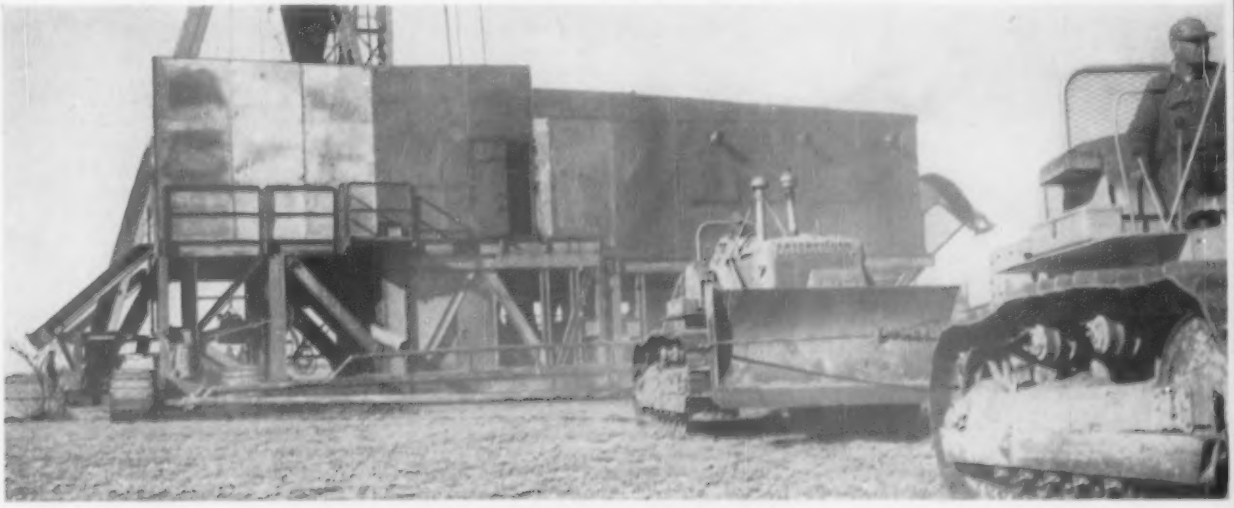
10 NEW LOCATION, half a mile away, is ready and waiting with cellar dug and matting in place as rig approaches 8 hours later. Two 30,000-lb. mud pumps, only major equipment items hauled separately, will be positioned on preleveled unitized matting via preset alignment lugs.



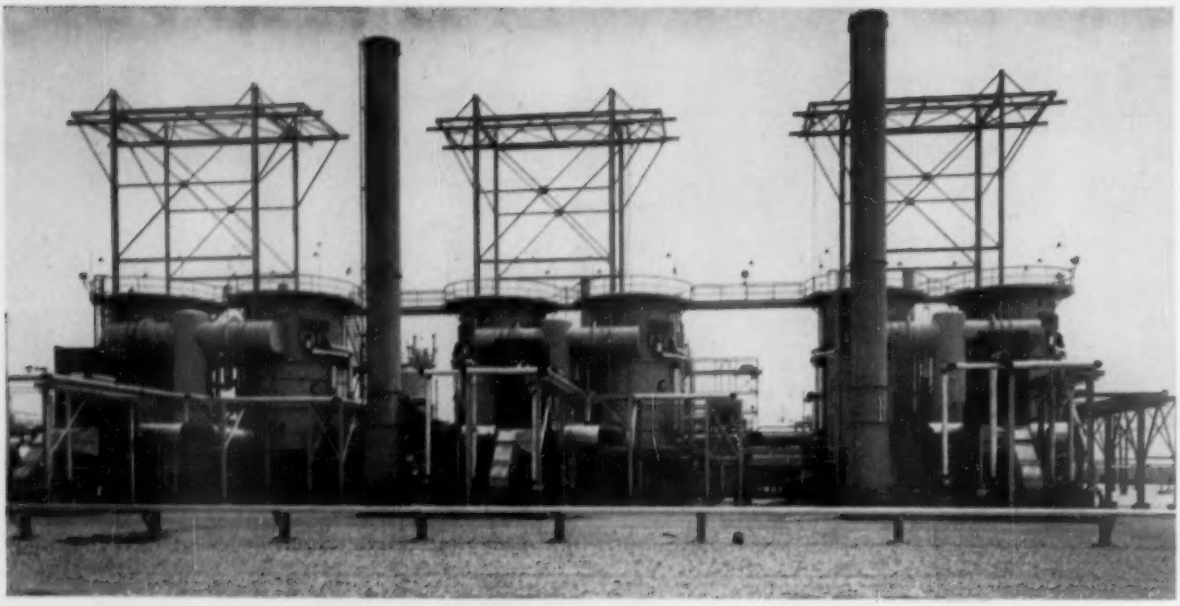
6 SKID BEAMS are lowered in place on wagons and chained and boomed as an extra precaution. Large pins allow drawbar to be easily attached.

7 DRAW AND SPREADER BAR are pinned in place and dozers (two D7 and one D8 Caterpillars) are maneuvered into pulling position.

9 DOZERS REV UP, tighten against drawbar, and rig is moved off old location. Dust flies as rig picks up momentum and takes off across country. Unfenced flat land country lets dozers take a direct route to new location.



11 DOZER DIGS IN and pulls rig into drilling position at new location. Other dozers are unhooked and give unit a few final nudges from various angles to get exact lineup. Skidding preparations are reversed, aligned mud pumps are quickly rigged with V-belts, and rig is virtually ready to make hole again.



Natural gas from Phillips Chocolate Bayou field processing plant is starting point for . . .

Ammonia Manufacture by Gas Reforming

Adams Terminal plant has capacity of 450 tons daily

by John C. Reidel
Petrochemical Editor

AMONG its rapidly growing petrochemical facilities at Adams Terminal, on the Houston Ship Channel, Phillips Chemical Co. operates a large ammonia plant, with design capacity of 450 tons per day of anhydrous ammonia. The major portion of the ammonia is converted at Adams Terminal into ammonium sulfate. The remainder goes to industrial and agricultural sales and to the pyridines manufacturing operation at Adams Terminal. Both the ammonia and ammonium sulfate facilities were designed by Chemical Construction Corp.

- Natural gas is used at the ship channel plant to make hydrogen for ammonia synthesis. The natural gas comes through a 30-mile pipeline from the Phillips Petroleum Co. Chocolate Bayou natural-gasoline plant.
- The improved high-temperature radiant heater employed in the steam-methane reforming section is a feature of interest in this type of plant.
- It has been noted[1] that at Adams Terminal, Phillips Chemical Co. also owns and operates facilities for manufacture of triple superphosphates providing the company with fertilizer materials supplying two of the three major plant foods. The company makes ammonia, ammonium nitrate, and nitrogen solutions in the government plant at Etter, Tex., which it leases and operates.

Other activities . . . Latest step in rapid expansion of chemical processing by Phillips at the ship channel site is in polyethylene. Contract was let recently for construction of the 110-million-pound per year, low-pressure polyethylene plant. This will connect with a 75-mile pipeline to the ethylene plant being built at the Sweeny, Tex., refinery. Other activities of Phillips in the chemical business are listed in Table 1.

How Primary Gas Reform Operates

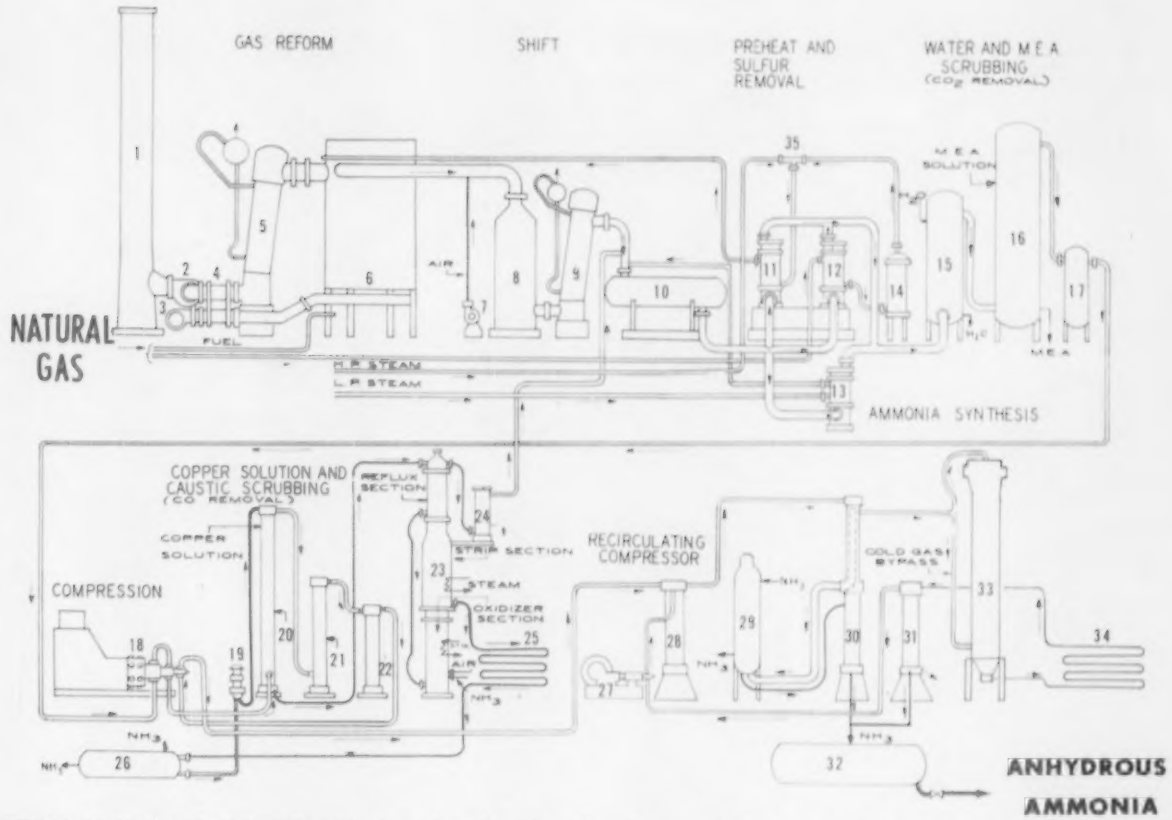
The diagram of Fig. 1, while not identical with the Phillips Adams Terminal operation, serves to illustrate the production of ammonia there.

Natural gas comes into the plant at about 80 psig. All process gas for reforming is first passed through activated carbon to remove trace amounts of sulfur. The gas together with the process steam is then preheated, utilizing excess heat from the CO conversion step. The preheated gas-steam mixture then goes to the reformer furnace (6).

Primary reform . . . Reaction between natural-gas components and steam is promoted by the nickel catalyst in the primary reformer reaction tubes. All but a small amount of the methane is converted to hydrogen, carbon dioxide, and carbon monoxide. Reactants flow through the catalyst tubes in parallel. This is a highly endothermic reaction. It takes a lot of heat to make it go. Therefore the heater design is of particular interest.

Catalyst-packed tube heater . . . The heat-transfer mechanism in the Chemical Construction Corp. heater and performance data on this heater have been presented by McCarthy.[3] He states that average tube-skin temperature in this type of heater is in the range 1,225°-1,525° F. The heater is shown in Fig.

PETROCHEMICALS



STEAM-METHANE REFORMING.—Natural gas is used at the Adams Terminal plant to make hydrogen for ammonia synthesis. Design plant capacity is 450 tons per day of anhydrous ammonia. Fig. 1.

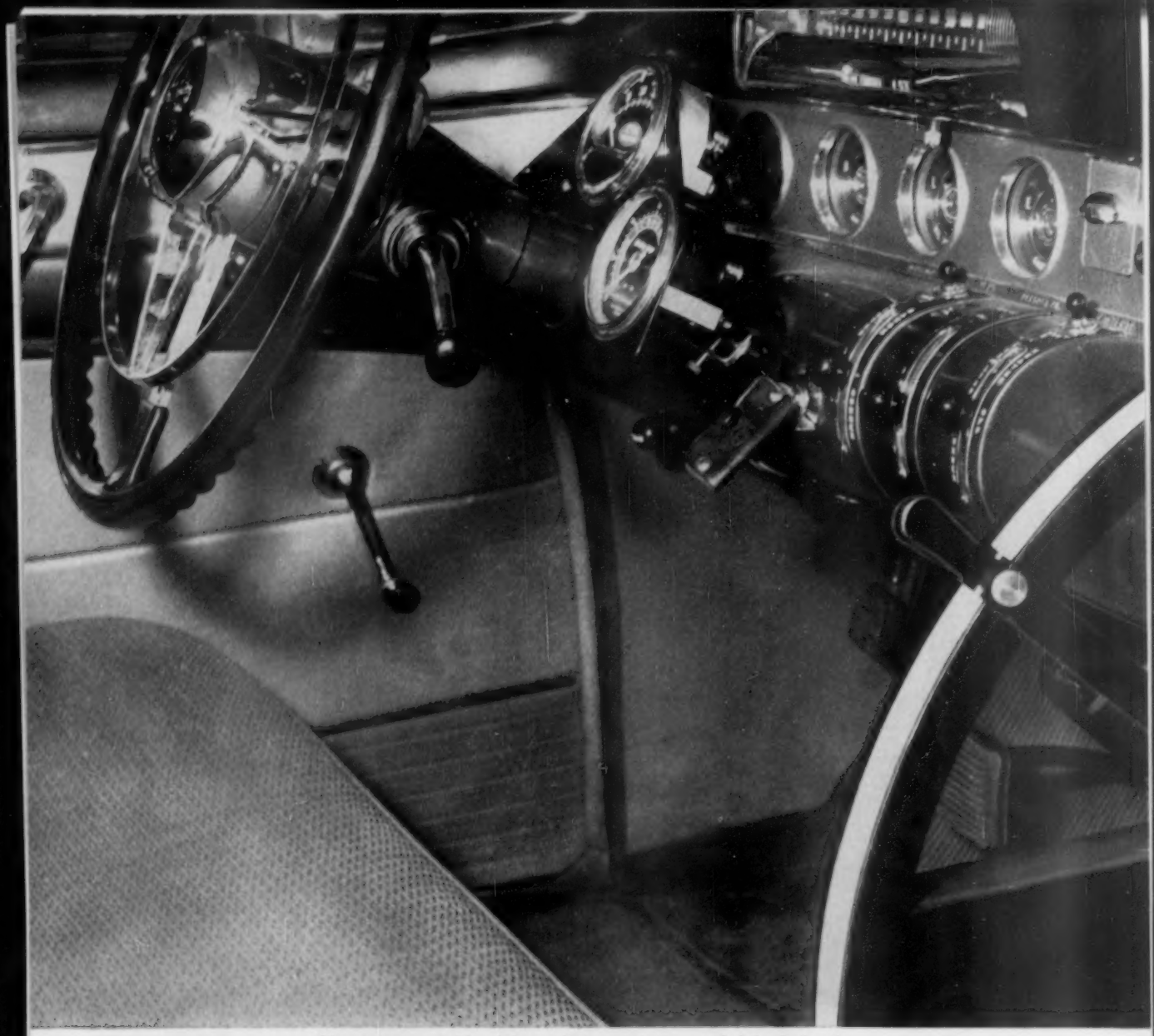
1. Stack
2. Induced-draft fan
3. Forced-draft fan
4. Air preheater
5. Flue-gas waste-heat boiler
6. Reformer furnace
7. Air blower
8. Secondary reformer
9. Reformed-gas waste-heat boiler
10. Co converter
11. High-pressure steam preheater
12. Gas preheater
13. Low-pressure steam preheater
14. Sulfur-removal vessel
15. Reformed-gas scrubber
16. Amine scrubber
17. Separator
18. Compressor
19. Copper solution high-pressure pump
20. Copper solution scrubber
21. Caustic solution scrubber
22. High-pressure separator
23. Copper solution regenerator
24. Water washer
25. Water-cooled copper solution cooler
26. Ammonia cooled copper solution cooler
27. Recirculator
28. Filter
29. Ammonia cooled condenser
30. Cold exchanger
31. Separator
32. Storage tank
33. Converter
34. Water-cooled condenser
35. Steam-gas mixer

2. Note arrangement of tubes in four rows, in the form of a cross, so that the heater is divided into four radiant-combustion zones. Each bank of tubes is connected to an inlet and outlet manifold, both of which are toward the upper end. A group of burners is located in each of these zones, firing vertically upward from the heater floor. Radiation is therefore direct to both sides of the tubes and the refractory wall, with reradiation taking place from the wall to tube banks.

Note projection of the heater tubes through refractory collecting duct toward top of heater. This duct is arranged as a cross with four legs which act to direct the flue gases into closer contact with the upper ends of the heater tubes. Flue gases exit through one leg of the cross-shaped duct.

How heat is transferred . . . Construction of the packed tube is shown in Fig. 3. Flow of reactant fluid is from nozzle A downward, through catalyst

CONTROL ROOM for gas-reform section.



Above, test car with minimum instrumentation needed for fuel rating.

How Ethyl Research equips a car for accurate fuel ratings

Ethyl Research has for years been active in developing more accurate and economical ways of obtaining fuel ratings on the road—offering refiners convenient methods for evaluating their gasoline stocks.

At Ethyl Laboratories, we have found that the various road rating procedures can be adequately handled by a grouping of just five instruments, some of which can be seen in the picture above. But we have discovered that the addition of other key equipment (see right-hand page) can facilitate your road testing operations.

Our people have accumulated hundreds of thousands of miles of road testing experience with this equipment. If you would like more

Right, equipment suggested for more complete test-car setup.

information about this subject, please contact your Ethyl technical representative.

INSTRUMENTS SHOWN in this advertisement have proved satisfactory in Ethyl test cars but are not necessarily endorsed by Ethyl Corporation. Although the products of some specific manufacturers are shown, several of the instruments are made by various companies, and we'd be glad to mail you a list of sources. Just send your request to Box 11, Ethyl Corporation, 100 Park Avenue, New York, N.Y.

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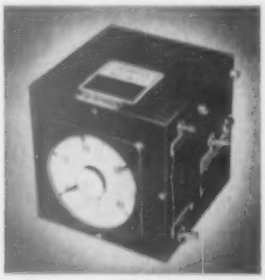
Electronic spark protractor provides an accurate method for continuous indication of spark advance. It gives direct readings at all speeds.

Timing light (above), calibrated flywheel and sight tube are used for obtaining instantaneous spark advance position. Flywheel is marked in crankshaft degrees.

Auxiliary fuel system facilitates testing of several fuels in succession. Simple coupling connects the auxiliary line to the inlet side of the fuel pump.



Tachometers are accurate mechanisms for measuring the engine speed. They are adaptable for operation with any six- or twelve-volt system.

Vacuum gauge is required for part-throttle ratings. At any given car speed, the vacuum gauge permits reproducing part-load conditions.

Selector switches for thermocouples and resistance bulb thermometers are needed to permit reading temperatures at various locations

Thermocouples and resistance bulbs are used to measure the temperatures of the coolant, the lubricating oil, and the air entering the carburetor.

Potentiometer is used to indicate the temperatures measured by the thermocouples. Road ratings require a rugged instrument, insensitive to vibration.

TABLE 1—PHILLIPS IN THE CHEMICAL BUSINESS

Plant and location—	Raw material	Products	Capacity	Uses
Adams Terminal, near Pasadena, Tex.	Natural gas, sulfuric acid.	Ammonia, ammonium sulfate.	450 T/D of ammonia	Mostly for fertilizer.
	Phosphate rock, sulfuric acid.	Triple superphosphate.	405 T/D	Fertilizer.
	Ammonia, acetaldehyde.	Methylethylpyridine, methylvinylpyridine, mixed pyridines.	3,000,000 lb. per year total pyridines.	M.V.P. for acrylic fibers (Acrilan); new uses in synthetic rubber, plastics, etc.
	Ethylene (from Sweeny refinery via pipeline)	Polyethylene (low pressure process under construction).	110,000,000 lb. per year	Plastics.
Refinery near Sweeny, Tex.	Refinery streams (ethylene - ethane); possibly also L.P.G. (propane).	High-purity ethylene (under construction).	120,000,000 lb. per year of ethylene.	
Cactus Works, Etter, Tex.†	Natural gas.	Ammonia, ammonium nitrate, nitrogen solutions. (Nitric acid made at Etter for internal use.)	500 T/D NH_3	
Phillips, Tex. (near Borger):				
Superfractionator facilities	Natural-gas liquids.	Hydrocarbon concentrate fractions including high-purity chemical intermediates such as cyclohexane.	Over 60,000 bbl. per day of natural gas liquids.	Cyclohexane to nylon. 17,000,000 gal. per year.
Plains plant	High-purity n-butane.	1,3-Butadiene (grade for elastomers); 1-butene, 2-butene and mixtures; butylene concentrates; methyl butenes.	74,000 short tons per year	Mostly to synthetic rubber.
Copolymer plant	Butadiene, styrene.	Synthetic rubber.	Synthetic rubber capacity 66,000 long tons per year	Tires, etc.
Philblack plant	Aromatic extract from Phillips, Tex., refinery, etc.	Furnace blacks.	Total capacity (Philblack A. & O.) 295,800,000 lb. per year	Tires, etc.
Philtex experiment station	Petroleum fractions.	Specialty chemicals.		
Refinery	Propane-propylene stream. Aromatic oil feed for furnace blacks.	Dodecene (propylene tetramer).		Synthetic detergents.
Crane County, Texas	H_2S concentrate stream from sour natural gas.	Sulfur.	31,000 long tons per year	To sulfuric acid, other chemicals.
Goldsmith, Tex.	H_2S concentrate stream from sour natural gas.	Sulfur.	36,500 long tons per year	
Big Spring, Tex.	Petroleum xylenes (from adjacent Cosden Petroleum Corp. refinery).	p-Xylene.	3,285,000 lb. per year	Dacron.
Arco, Idaho	A.E.C. reactor station (Phillips operator).			
McGregor, Tex.	Air Force Rocket Propellants Plant (Phillips contractor-operator).			
Phillips Pacific Chemical Co., southeastern Washington*	Natural gas.	Ammonia.	200 T/D	

*Formed by Phillips and Pacific Northwest Pipeline Corp. to complete plant by late 1956. †Government facility leased and operated by Phillips.

in outer tube to the lower end of the tube close to burners at B. Fluid now flows upward through inner tube and leaves heater through nozzle C.

As it flows down through outer tube the reactant mixture picks up heat from the radiant section. As it moves up through the inner tube, heat is transferred through the walls of the inner tube to the down-flowing gas in the annulus. This affects reduction in furnace load and fuel consumption, since it means a reduction (proportionately) in the heat transferred from the radiant section of the furnace to the outer tube.

McCarthy[3] has also noted other thermal and mechanical advantages in this type of construction. These may be summarized quickly: (1) maximum heat transfer is obtained at any given tube-skin temperature, (2) lower metal temperatures are possible than in conventional arrangements, (3) tube can be supported at upper end and free expansion downward is permitted to minimize mechanical strain, and (4) exit gas is at lower temperature and therefore easier to handle due to heat it has given up through walls of inner tube, being reduced perhaps from 1,500° F. (while going through catalyst bed) to less than 1,100° F. as it leaves the heater.

Other Processing

Secondary reform . . . The primary reform products mixture goes to the secondary reformer (8) to complete the conversion of residual methane over nickel catalyst in this vessel. Air is supplied to the secondary reformer which is provided with a burner at inlet. Addition of air is controlled, since it not only furnishes oxygen for combustion but must also provide nitrogen in correct proportion for ammonia synthesis.

To improve reformer-section thermal efficiency, waste-heat boilers are employed as shown.

Shift . . . In this step the gas stream is mixed with steam which reacts with the carbon monoxide over an iron oxide catalyst to form carbon dioxide and more hydrogen. The gas stream leaves the shift converter at approximately 25 psig. This synthesis gas stream from

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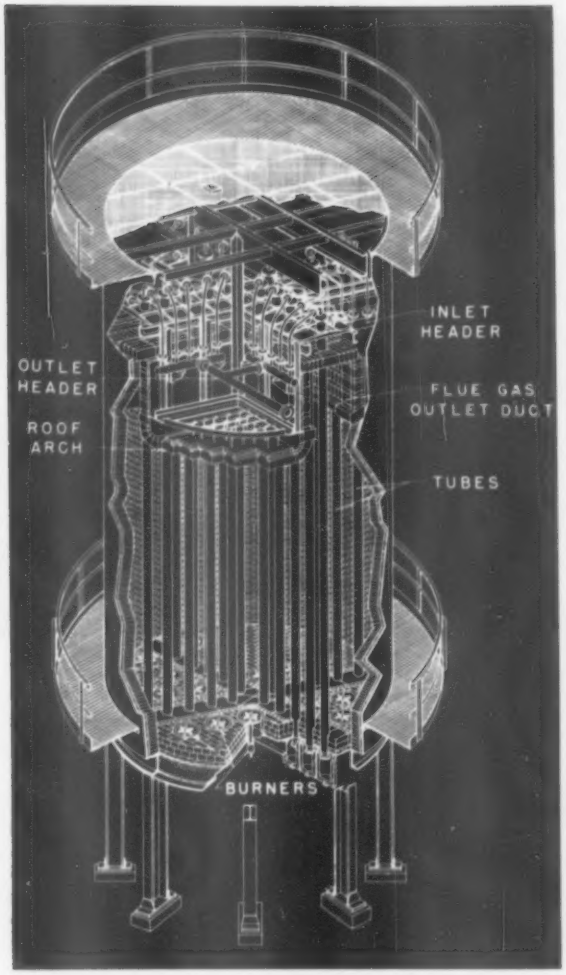
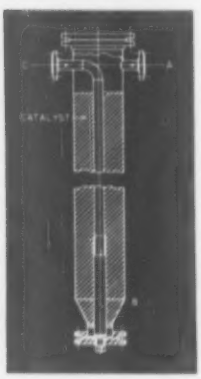


HIGH - TEMPERATURE reform heater. Tubes are arranged in four banks in form of a cross in this Chemico heater. Many heaters of this type are being used with the hot spot in the catalyst in the range of 1,300° to 1,550° F. and with tube-skin temperatures as high as 1,800° F. Fig. 2.

CATALYST TUBE. With this arrangement of inner and outer tube both inlet (at A) and outlet (at C) are brought to upper end of large outer tube, making it possible to support it at upper end and permit free expansion downward. Lower end is simply guided and allowed to elongate freely in insulated housing. Fig. 3.



the shift converter (10) now passes through several heat exchangers giving up its heat to the incoming reaction gas and steam. It is then cooled by scrubbing with water in (15).

Gas purification . . . Carbon dioxide is removed by contacting with aqueous M.E.A. solution in (16). Amine solution is regenerated in amine stripper (not shown) and recycled to M.E.A. contactor (16). Since the Adams Terminal ammonia plant is a large one, both the gas reform and CO_2-removal sections are divided into three trains, each designed to make synthesis gas for manufacture of 150 tons per day of ammonia.

A common header takes synthesis gas from each train to nine 2,200-hp. gas-engine-driven compressors. The gas is compressed in four stages to about 1,850 psig. At this interstage pressure it is contacted with an aqueous solution of copper ammonium formate and carbonate, to remove mainly CO and also residual CO_2 and O_2. Following CO removal in the copper solution contactor (20) synthesis gas goes through the caustic solution scrubber (21) to reduce CO_2 content to a trace, and through the high-pressure separator (22) to the last stage of compression. Here gas pressure is raised to some 5,000 psig. for the ammonia synthesis step.

Copper solution regeneration . . . This takes place in the three-section regeneration vessel (23). Rich copper solution down in the packed-reflux section contacts ammonia vapors and CO flowing up from the stripping section. (Some CO is released from the copper solution in the reflux section and still more is liberated in the stripping section.) The CO is burned, but could be vented to the atmosphere, or recycled back to the shift reaction step, as shown. The ammonia is reabsorbed and the copper solution flows down through the outside line to the oxidizer section. Here air is added to oxidize cuprous to cupric ion and makeup ammonia is added. More on this particular operation is given elsewhere.[4] Regenerated copper solution goes through water cooling (25) and ammonia refrigeration (26) before returning to the suction of the high-pressure copper solution pump (19).

Ammonia Synthesis

Synthesis gas goes to the oil filter (28) where it mixes with circulating gases (some uncondensed ammonia, unconverted nitrogen and hydrogen, and small amounts of argon and methane). The gas mixture goes through the cold exchanger which is the upper portion of vessel (30), and through the ammonia refrigerated condenser (29). In the latter ammonia is condensed and separated in the secondary separator which is the lower part of vessel (3). Traces of CO_2 and water vapor are also removed by condensation in (29).

N.E.C. converter . . . After separation from condensed ammonia in (30) the gas goes up through the cold exchanger and enters the ammonia converter (33). This is an N.E.C. converter which has been described by Hein.[5] Note that main gas flow is to top of converter. But a cold gas bypass is provided toward the bottom to permit control of catalyst-bed temperature. Conversion of a portion of the nitrogen and hydrogen to ammonia takes place over a promoted iron catalyst.

Reaction products from the converter go through a water-cooled condenser (34) and ammonia is removed in the primary separator (31). A second stage of condensation in (29) follows, as explained. Removal of CO_2 and water-vapor traces in this secondary condensation aids in maintaining high catalyst efficiency and increasing catalyst life.

At Adams Terminal ammonia is stored in four 1,000-ton spheres cooled by ammonia refrigeration. All waste gas streams in the plant are absorbed in water to recover the ammonia content. This is accomplished by distillation to meet specifications for refrigeration grade ammonia.

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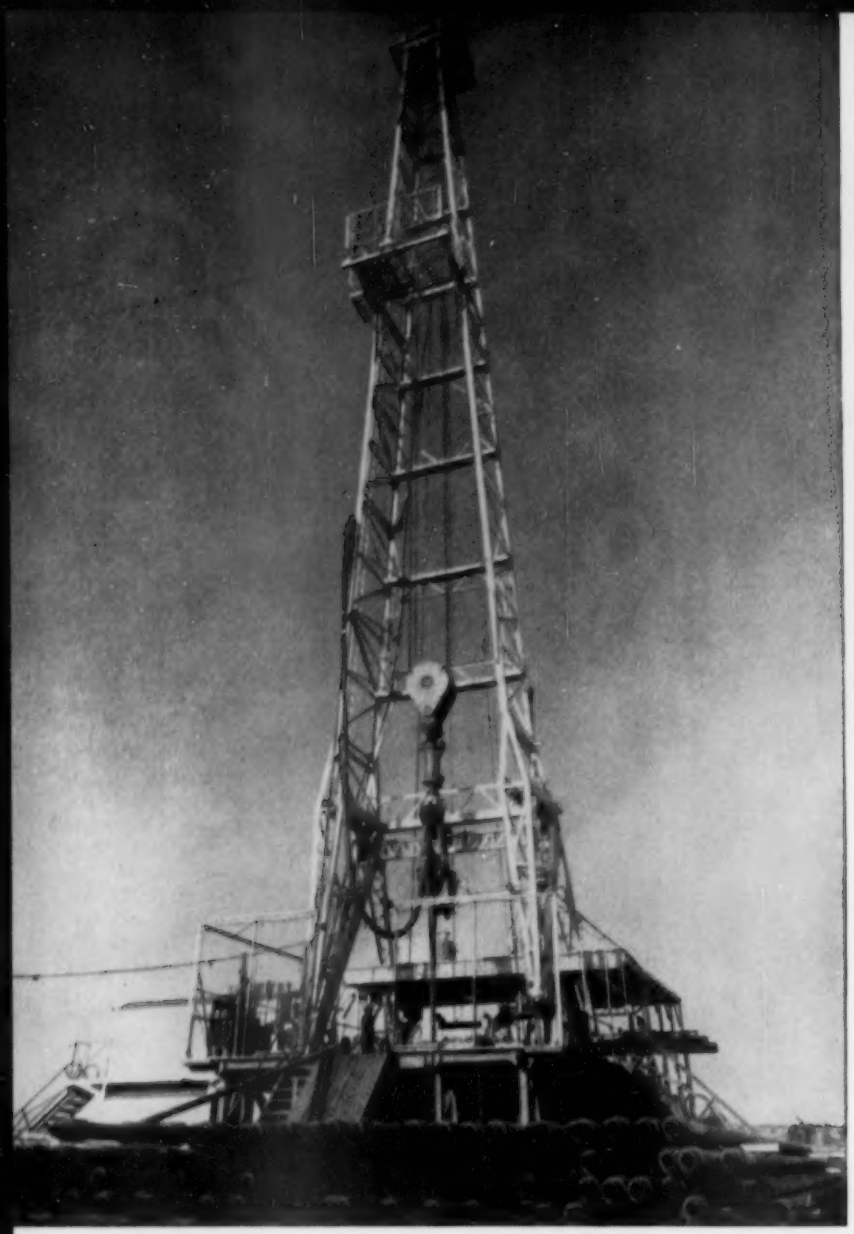

Designed for speed in drilling, this rig drilled 7,400 ft in 16 days at a location near Lindsay, Oklahoma. Carrying 40,000 lb of weight at the bit, it was pumping 641 gallons of mud a minute at 1,800 lb pump pressure to pulverize sand and rock and increase the drill's boring speed.

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This rig with all its equipment —including Pittsburgh Steel Company's seamless 4½ in. OD

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Independents are accessible. The distributors at right have 141 stores covering all major oil fields in this country and some abroad. Yet each distributor individually concentrates his services in the home areas he is best qualified to serve.

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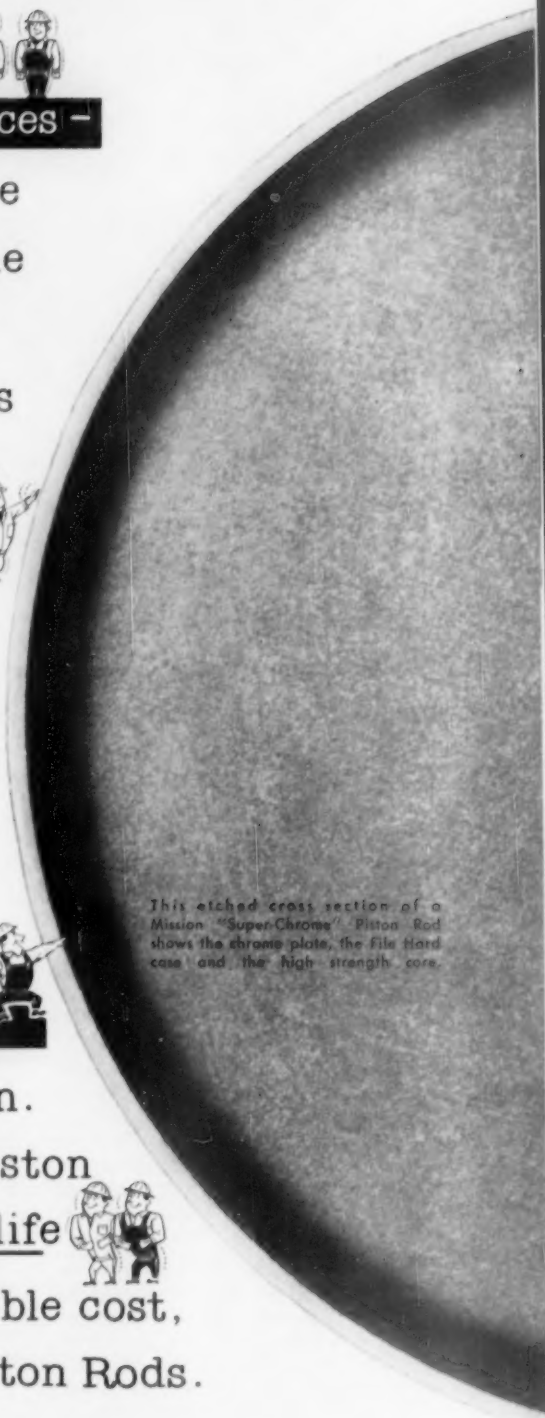

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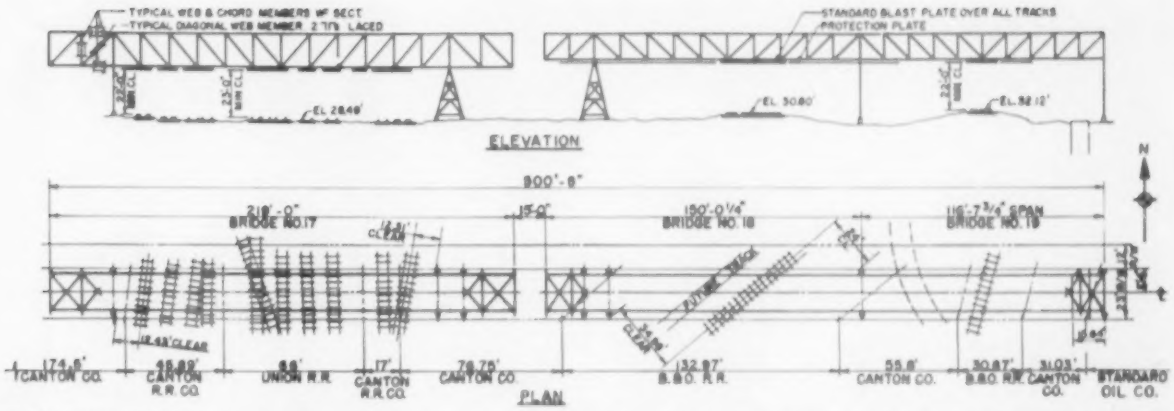


ELEVATION AND PLAN of piping bridge system at Baltimore refinery, Esso Standard Oil Co., showing dimension of right-of-way through property of the several railroads, position and direction of present and future railroad trackage, and dimensions of piping bridge system.

Piping Bridge Replaces Underground System

Original system, installed some 30 years ago, had seen many additions, resulting in the stacking of lines in a complex pattern. This and other complications dictated an overhead bridge for the piping

by E. G. Fitzgerald

UNIQUE engineering and field construction problems complicated by the almost continuous movement of railroad traffic, were encountered in construction of an all-welded, structural-steel, three-span, 500-ft. piping bridge system. This has been erected at the Baltimore refinery of Esso Standard Oil Co. It links the major crude and finished product storage area with the refinery's main processing area.

The areas mentioned are separated by the operating property of the Baltimore & Ohio, Canton, and Union railroads which serves as the roadbed for 13 tracks, 4 of them in major service, leading to the Canton freight terminal. The traffic frequency over these tracks approximates one freight train, moving in either direction, every 10 minutes around the clock.

The project, which called for considerable field engineering, as well as total field assembly and erection, had to be undertaken with conditions imposed by these rail movements. Only the minimum interference with railroad operations was allowed. Consequently, it called for the closest cooperation and the orientation of such widely differing interests and operations as those of the railroads, the refinery, the consulting engineers who designed and coordinated the piping bridge system, and the company which fabricated the bridge.

Author is associate engineer with James P. O'Donnell, consulting engineers, New York.

Right-of-way . . . The storage area, and the process area to the east of it were formerly linked by an underground piping system crossing the railroad property in a right-of-way approximately 35 ft. wide. One phase of the total problem was to locate the piping bridge within the confines of this right-of-way, but with consideration given to the placement of foundations and bridge supports in areas clear of all railroad trackage both present and future.

The underground piping system was originally installed through the right-of-way about 30 years ago, and during the years numerous additions were made to it. This resulted in the stacking of lines in several layers in an extremely complex pattern. A further complication arose from the fact that while the precise positions of certain lines were a matter of record, the positions of other lines were not clearly defined. This was due to on-the-spot improvisions necessarily made to accommodate the additions within the confines of the narrow right-of-way. These lines were probed for and located through field engineering procedure.

Bridge Design

Because of the positions of the 13 tracks which vary, directionally, from approximately north-south to northeast-southwest with several variations thereof, long series-span bridges were necessary.

The over-all length of the bridge system is 500 ft., 8 in. It consists of one individual bridge, designated as Bridge 17; a 15-ft. expansion gap; and two connected simple spans designated as No. 18 and No. 19. Bridge 17, 219 ft. in length, has a 30-ft. cantilever at each end and a clear span of 159 ft. which is unusually long for a piping bridge. Connected bridges 18 and 19 are 266 ft., 9 in. over-all with clear spans of 126 ft. and 116 ft., 7¾ in. respectively.

The cross-sections of the piping support portions of the bridges were determined by pipe-rack-capacity requirements and adequate structural dimensions. Combining structural requirements and rack capacity the cross-sections resulted in dimensions of 17 by 16 ft. for Bridge 17, and 17 by 12 ft. for Bridges 18 and 19. The basic capac-

ity of the bridge system is 39 crude, commodity, and service lines carrying from 4 to 24 in. Provision is made for the addition of future lines. Fig. 1 shows a typical cross-section through the bridge.

Foundations and Bridge Support Design

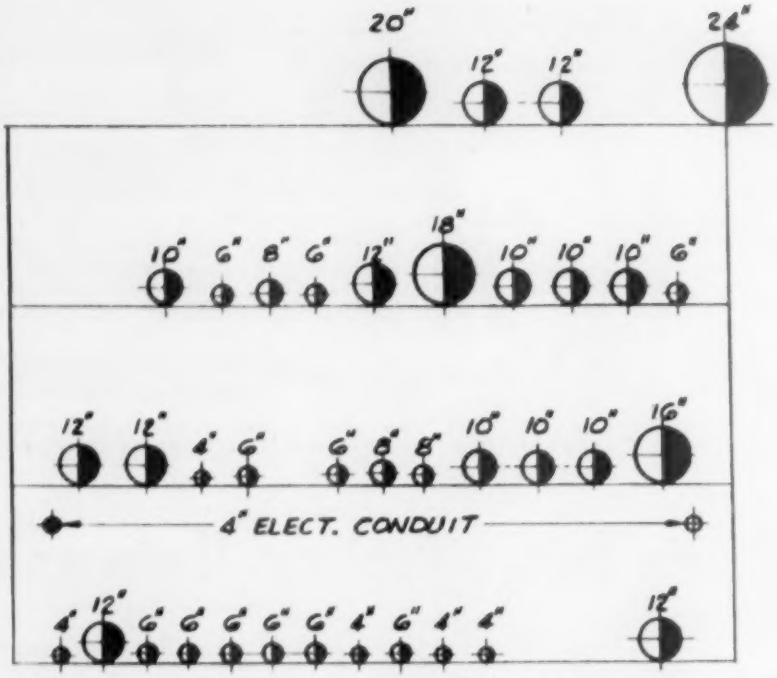
All foundations are cast-in-place concrete piles and concrete caps with concrete pedestals supporting the steel of the bridge superstructure.

Soil conditions . . . Borings indicated that soil conditions were a miscellaneous fill, and no dependable soil was available for at least 12 to 13 ft. below grade for a spread footing. This suitable soil was beneath the network of underground piping making the areas for foundations inaccessible by ordinary procedure.

After study of the various factors involved, including the difficulties of excavation and concrete work, this problem was approached by temporarily relocating piping wherever possible. It was decided that the design of foundations would include piling so placed as to cause only a minimum of interruption in service of the remaining particularly selected lines.

Tight clearance . . . The very tight clearances met in this procedure made it necessary to drive piling with extreme care to prevent damage to, or rupture of, in-service lines. The matter was handled by carefully excavating to the underground lines, then clearing a small space by moving the permissible lines, and finally driving piling through the cleared space with cutoff above the top of the lines. A cap then was poured connecting two rows of piling and the bridge was centered on the cap to meet overhead requirements. Pedestals were placed on caps at points convenient to support of overhead structures.

Flexibility . . . Considerable flexibility was necessary in making design details, which could not be determined until after excavation. An example was the design of the footing for the support of the east end of Bridge 19. The underground piping pattern at this point was known from history and memory to be extremely complicated. The piping followed no definite pattern, and it obstructed almost all space when the footing and pedestal were to be placed to a depth of 12 to 13 ft. As a result, a decision was made to defer design of this footing until after excavation, and then to design to satisfy load requirements. Ultimately this led to a spread footing placed about 15 ft. below grade at a suitable spot selected for the pedestal, clearing underground and aboveground piping, and satisfying structural requirements.



CROSS-SECTION through bridge. Provision has been made for future additions. Fig. 1.

Bridge Fabrication and Erection

Since the bridge required a considerable quantity of structural steel, the usual pattern of shop prefabrication prevailed. However, because of the railroad's restriction on interruption of service, the procedure differed somewhat from the conventional.

Assembly in field . . . A subassembly area approximately 200 ft. long, clear of all tracks, was located almost in the center of the railroad property. This made it possible to lay out and plan shop assembly members in an area reasonably adjacent to the final position of the structures. Because height of certain trusses of this bridge exceeded railway clearance, it was necessary to complete the subassembly of these trusses in the field. All subassemblies delivered from the shop were welded into bridge sections and progressively placed in position on bents and temporary supports according to a planned procedure.

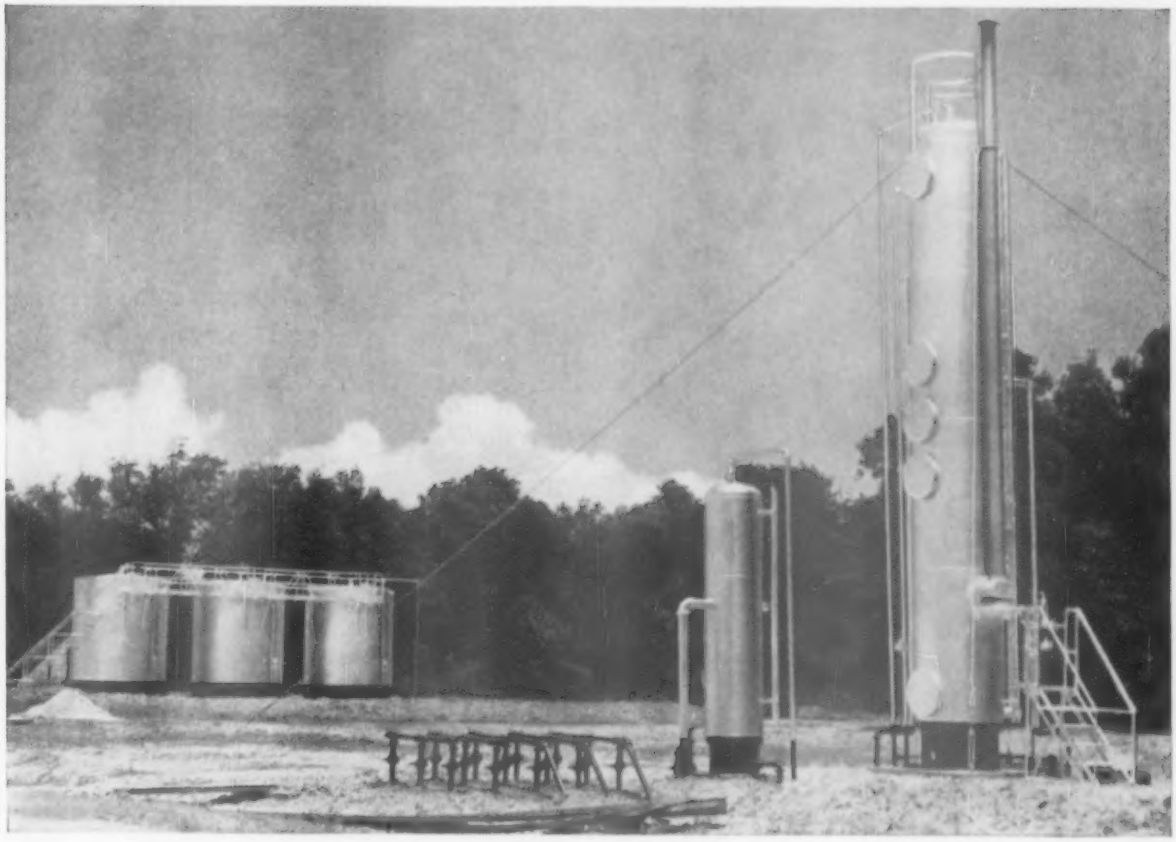
"Look, no wonder he's been raising old Ned about our diggin' here."

The maintenance of the proper camber in all trusses as field welding progressed was an important feature in the erection of this steel.

The largest individual section assembled, welded, and raised was 65 ft. long. This section was a part of Bridge 17. The railroads agreed to suspend service for a period of 4 hours for the erection of this section, but because of precise planning, the 65-ft. span was raised by mobile cranes and positioned in about 2 hours.

Acknowledgment

James P. O'Donnell, consulting engineers, designed and coordinated the piping bridge project. Lee C. Moore Corp. fabricated the bridge and erected it. Over-all project control, economics and coordination was by the project engineering section of Esso's Baltimore refinery, mechanical engineering division. E. N. Diver was Esso project engineer on this assignment.



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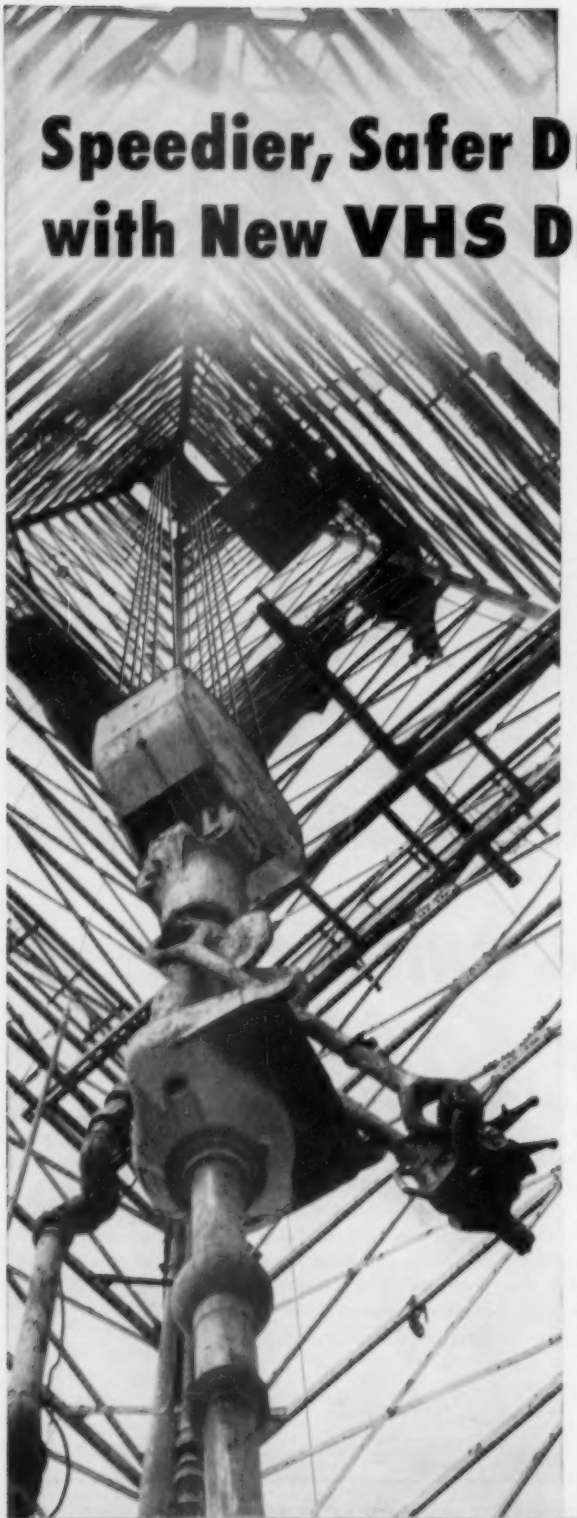

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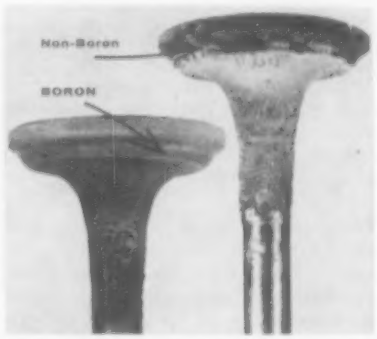
by E. C. Hughes, P. S. Fay, and W. T. Wotring

IT has been shown in a number of ways that a boron compound is a valuable component of gasoline. There is evidence that in some forms it would often result in a lower vehicle octane requirement when consistently used.[1 2 3 4] In particular, an extensive study on automotive effects was described in September 1955 before the Petroleum Division of the American Chemical Society by the present authors.[5] There it was shown that a boron compound* in gasoline modifies engine deposits in several desirable ways. For example, in the hotter areas of the combustion zone the friability of the deposit was increased, leading to better scavenging. Particularly when it was used with all-bromide tetraethyl lead fluid there was a marked reduction in combustion-zone deposits. The effect was most noticeable on the exhaust valves where only about half as much leaded deposits formed. This was reflected in much longer valve life in numerous tests under vigorous conditions. Table 1 and Fig. 1 illustrate this effect which can be so important to the customer.

To the refining departments this boron compound can also be of direct value in their major problem of meeting antiknock specifications economically. This problem extends well beyond the F-1 knock rating since octane number will not necessarily control wild pinging. The product must not make any kind of noise in the customer's car, either knock or wild ping. Evidence has been given[6] that full-range catalytic gasolines are poorer than undercut gasolines on surface ignition. This has, in part, induced some refiners to lower end point and thus raise costs. Furthermore, as Boyd, Danke, and White[7] show, the trend is toward more "sensitive" fuels as octane number increases. This will lead[6 8] to a further increase in noises induced by surface ignition. It is highly desirable therefore to have a further way of getting antiknock which will also tend to suppress surface ignition (and the deposits which in part cause it). This article will show how gasoline containing the boron compound can do this.



USE OF BORON reduces leaded deposits formed on exhaust valves. Fig. 1.

*The boron compound of this paper is a specific gasoline-soluble compound used by Standard Oil Co. (Ohio) in the production of its boron gasoline. "Boron" is a trademark of Standard Oil Co. (Ohio) for gasoline. T.M. Reg. pending.

Authors are with the chemical and physical research division and process and product development laboratories, manufacturing department, Standard Oil Co. (Ohio). Paper presented at regional meeting, Western Petroleum Refiners Association, Houston.

REFINING

Surface Ignition

Although there is still no agreement on a test method, there are several ways of observing and measuring surface ignition. The effect of the boron compound has been observed to be good with several types of tests. An unusual one involved the use of a C.F.R. engine having a full quartz head. After deposits were built up on the remainder of the combustion zone, the transparent head was put in place. Then the surface ignitability of various fuels was observed with a high-speed movie camera. Direct counts were made of the surface ignition spots. As we showed in an earlier paper,[5] much less surface ignition occurred when fuel containing the boron compound was used. This was particularly true in the critical early part of the explosion cycle.

Reducing wild ping . . . Similar results have been found with a 12:1 C.F.R. engine and road-test automobiles. For example, a 1956 Oldsmobile, having mild-duty equilibrium deposits, was giving bad wild pinging on hills with non-boron fuel. Adding boron compound to the base gasoline substantially reduced the number of wild pings. The extent of the reduction increased with boron content. A Buick 10:1 experimental engine with no deposit had an octane requirement of but 93 yet pinged seriously even with isooctane. Addition of boron compound to the isooctane or to the 93 reference fuel stopped the pinging almost completely. The effect in both cases was typical in that it re-

TABLE I—VALVE DURABILITY IN HEAVY-DUTY OPERATION

	Passenger		Trucks,
	Channeling	Burned	two valves burned
No boron—motor mix TEL	156*	3	27,000 miles
No boron—average mix TEL			55,000 miles
0.004 per cent B—average mix TEL	5*	0	None at 60,000—test stopped

duced the pinging almost immediately. Thus it appears to modify the surface ignitability of the fuel.

Further tests have shown that deposits built up with a fuel containing the boron compound cause less surface ignition than deposits from a nonboron fuel, even though the engine was tested with a nonboron fuel. Table 2 shows that the surface ignition count in a 12:1 C.F.R. test engine running on nonboron fuel was only half as large when the deposit had been built up with a fuel containing the boron compound. Surprisingly, the amount of boron compound used to build up the deposit made very little difference. This suggests that a refiner can vary the amount used to suit his knock-rating requirements and still count on favorably conditioning his customers' cars against surface ignition.

TABLE 2—SURFACE IGNITIONS IN 12:1 C.F.R. ENGINE—FUEL A

Deposit from fuel containing:	Surface ignition counts per 4 hours*
No boron	2,100
0.004 per cent B	1,050
0.02 per cent B	1,100

*Using nonboron fuel for test.

Thus the sustained use of the boron compound in its gasoline by a given refinery will improve its chance of satisfying its customers without resorting to excessive octane-number increases. This will be increasingly true as more and more new cars develop wild ping tendency above their normal antiknock requirement.[9,10]

Antiknock Properties

In addition to relieving the deposit problem and reducing surface ignition, the boron compound also can give the refiner a direct antiknock effect. Boron, as we put it in, was first shown to increase octane number in a leaded fuel in our paper[5] before the American Chemical Society last fall.

As shown in Fig. 2, the F-1 O.N. was increased by 0.3 with but 0.004 per cent B, and up to 0.9 units at 0.02 per cent B. These are useful levels and, in our refining operations, we are regularly utilizing the increases in helping to meet our octane-number specifications in the premium grade. Of course we were only justified in doing so because, as Fig. 2 shows, the prediction of the F-1 was found to be true on the road also. (The fuels used in this paper are described in Table 7.)

"Boron can be incorporated in many ways into gasoline . . . The boron component is a low-viscosity liquid and easily added with a proportioning pump as the gasoline goes to storage. We also add it directly to blend tanks with no difficulty. The toxicity is no greater than that of gasoline."

Like tetraethyl lead, there are many factors which affect the utilization of the boron compound strictly for its antiknock effect. Some that will be discussed here are:

1. Techniques of use.
2. Concentration of boron and TEL.
3. Sulfur.
4. Hydrocarbon composition.
5. Effect in typical gasolines and stocks.
6. Relation between F-1 and road ratings.

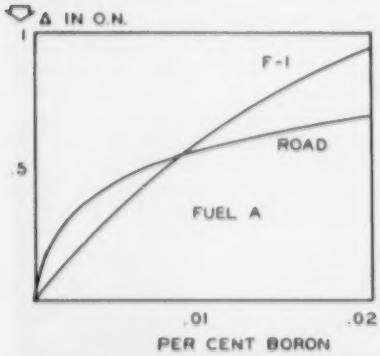
Techniques of use . . . Boron can be incorporated in many ways[1] into gasoline. Most of these are unsuitable for practical use because insoluble solids precipitate due to hydrolysis or oxidation or both. Furthermore, many compounds of boron are ineffective or even proknock (as are certain compounds of lead[10]). The compound we have selected has caused no automotive troubles on any score. Although it is possible to extract the boron with water in the laboratory, no loss has been observed in the field. A very large number of field and car tank samples have been taken over the past year and a half and the boron analyses are always within the error of the analytical method. Of course it has always been our practice to lean over backward to avoid water in our gasoline and this may have helped avoid any losses.

The boron component is a low-viscosity liquid and easily added with a proportioning pump as the gasoline goes to storage. We also add it directly to the blend tanks with no difficulty. The toxicity is no greater than that of gasoline and we have had no dermatitis or health troubles in making or blending the material.

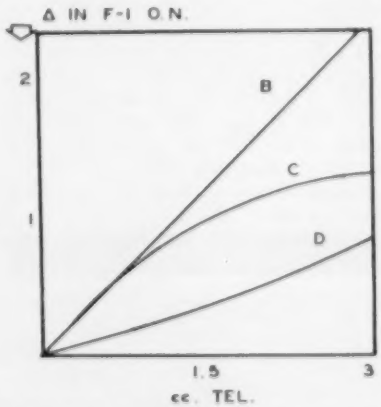
Effect of boron and TEL concentrations . . . The concentration of boron was between 0.002 and 0.08 per cent in most of our research work. At the highest concentration we found a valuable[5] purging action on combustion-zone deposits laid down in the absence of the boron compound. These purged materials collected on the exhaust valve tulip in such a way that we have not recommended such levels of boron concentration for commercial use. However, no such difficulties have been observed at 0.04 per cent B. In most stocks the useful antiknock activity appears in the concentration range up to that level, as will be shown in later data herein.

The best effect on antiknock has been in leaded fuels and all of our discussion here will be in highly leaded stocks. Fig. 3 shows that the antiknock effect for 0.02 per cent B increases as the lead content increases. (No difference was observed between motor and aviation mixes.) The maximum effectiveness comes along with the maximum use of TEL. Fig. 3 also shows that the antiknock effect of the boron compound varies widely with stock used. (The properties of these stocks are shown in Table 7.) Thus, in stock B the increase at the 3 cc. TEL level is 2.65 O.N. but in D it is but 0.9 O.N. These difficulties have led us to look for the causes, particularly among the factors which cause variations in TEL susceptibility, such as sulfur and hydrocarbon composition.

Effect of sulfur . . . We added sulfur to 80 per cent isooctane-20 per cent



INCREASE IN O.N. due to boron compound at constant levels of TEL. Fig. 2.



INCREASE IN O.N. due to boron compound varying TEL. Fig. 3.

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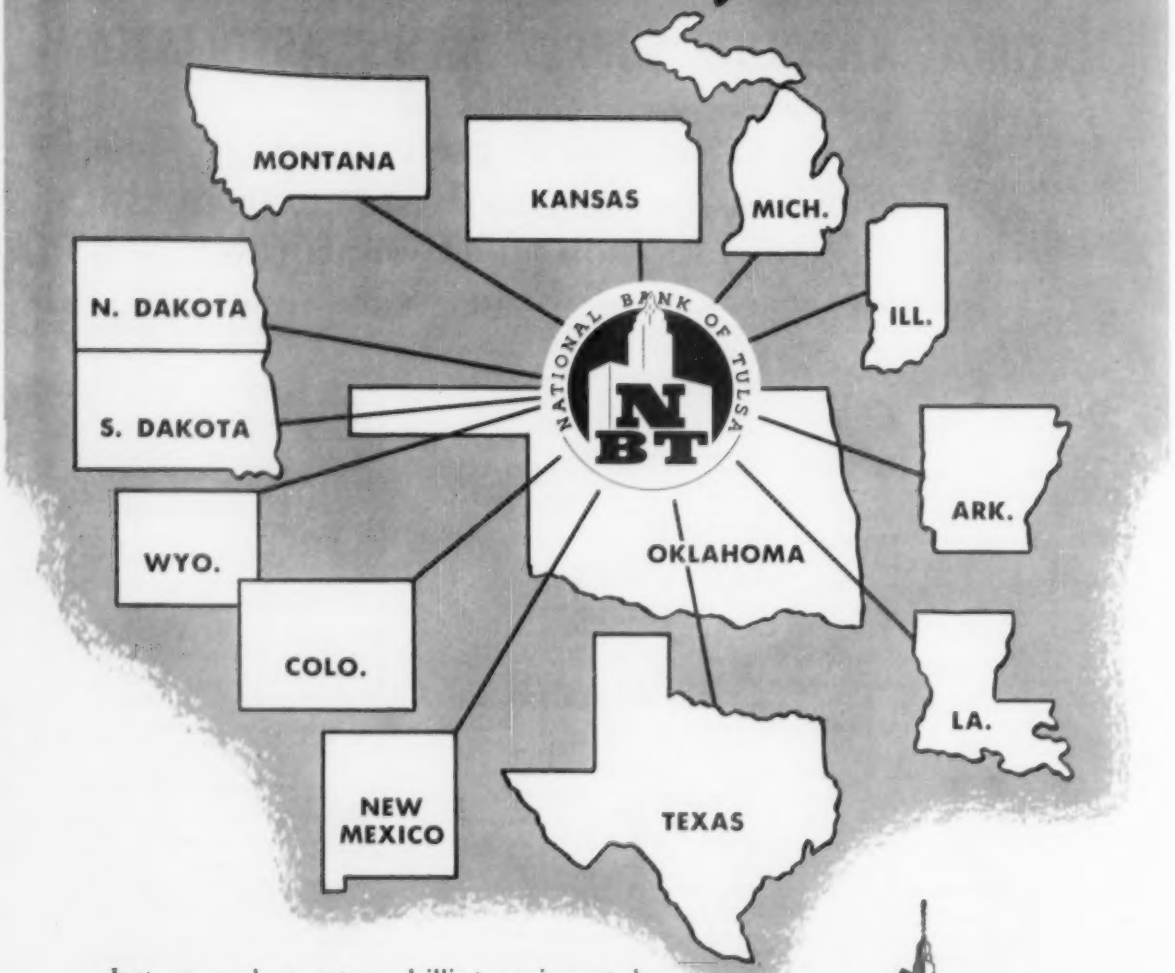

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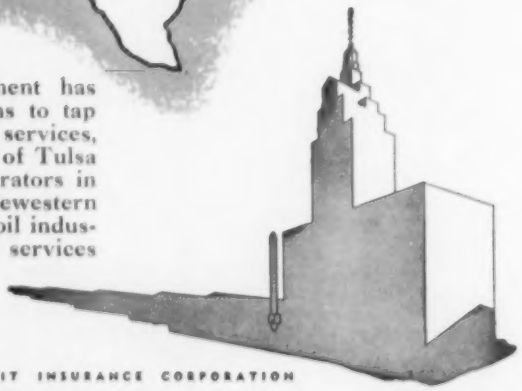

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heptane (leaded to 3 cc., as were all further stocks referred to), as shown in Fig. 4. We were surprised to find that sulfur compounds improved the antiknock effectiveness of the boron. Thus in Fig. 4 the stocks are practically sulfur-free and the benefit from 0.02 per cent B was 0.6 octane number. However, when 0.01 to 0.03 per cent sulfur was added (as various types of sulfur compounds) the effect jumped to 1.75 to 2.1 octane numbers.

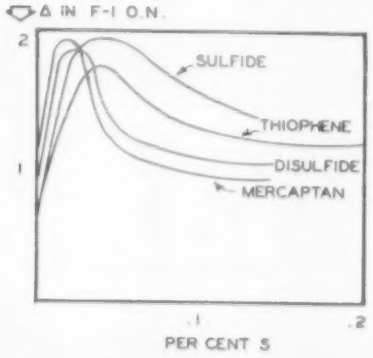
In Fig. 5 similar data are shown for the primary reference fuels plus two levels of toluene. In this case the effect peaks up between 0.03 and 0.06 per cent sulfur and then levels off out to 0.2 per cent, well above the no-sulfur response. In fact the higher aromatic blend shows a proknock effect for the boron compound at the no-sulfur level which changes to an antiknock effect with a trace of sulfur. Fig. 6 shows the effects of the boron compound and sulfur content on octane number of light virgin naphtha. This naphtha can be raised to nearly the same octane number with the boron compound as it can by desulfurizing.

At higher sulfur content, the boron was less effective, depending somewhat on the type of sulfur compound added. The effect of the boron compound evidently passes through a maximum as sulfur content varies in this fuel too. This, along with other data, suggests that part of its antiknock effect is caused by overcoming the antagonism of sulfur compounds toward TEL. However, as the desulfurized bars show, the effect is still definite in the very low sulfur naphtha from silica gel desulfurizing.

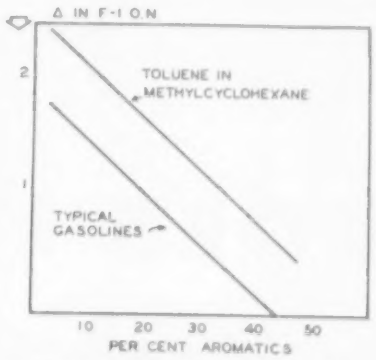
". . . There is evidence that aromatics or olefins or both are major factors in the boron compound's antiknock effect . . . Attempts to relate the antiknock effect of the boron compound to octane level, per se, have not been successful."

Hydrocarbon composition . . . Throughout these data there is evidence that aromatics or olefins or both are major factors in the boron compound's antiknock effect. Thus the maximum octane number increase due to the boron compound dropped from 2.1 in Fig. 4 (no aromatics) to 1.1 to 1.3 O.N. in Fig. 5 (35 and 25 per cent toluene). Benzene had no such adverse effect but xylene, cumene, and toluene progressively reduce the response to the boron compound. Fig. 7 summarizes considerable data showing a strong effect which, however, is not divorced from an important influence by the nonaromatic components present. The upper curve of Fig. 7 shows mixtures of methylcyclohexane and toluene. The response to the boron compound drops from 2.5 O.N. at 0 per cent toluene down to 0.2 O.N. at 50 per cent toluene. The lower curve is an average of many commercial stocks and blends. It shows that various gasolines containing 40-50 per cent aromatics will no longer respond to the boron compound as an antiknock. Of course, as Fig. 8 shows, it then becomes much more important to put it in for surface ignition control.

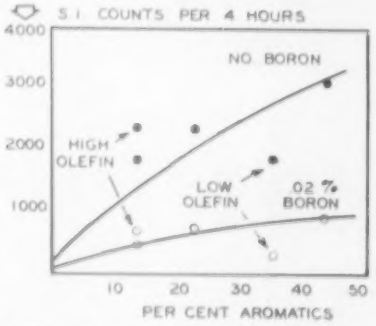
Olefins have such highly mixed effects that no generalization is possible. Consequently attempts to relate



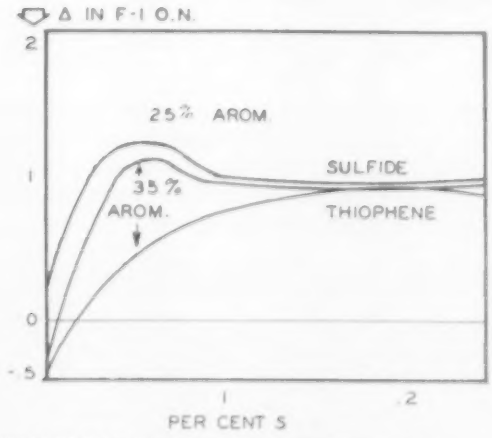
EFFECT OF SULFUR on octane benefit using boron. Fig. 4.



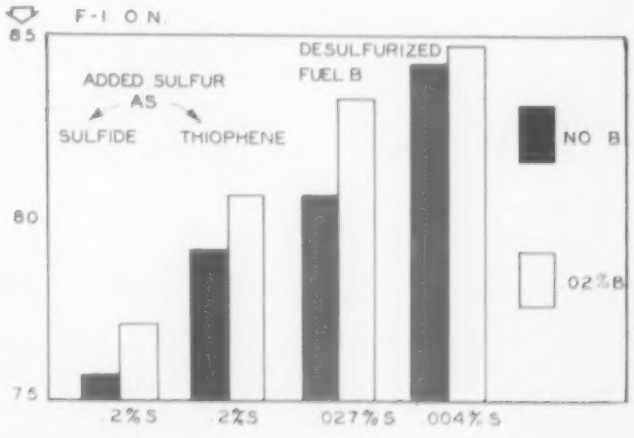
EFFECT OF AROMATICS content on boron benefit. Fig. 7.



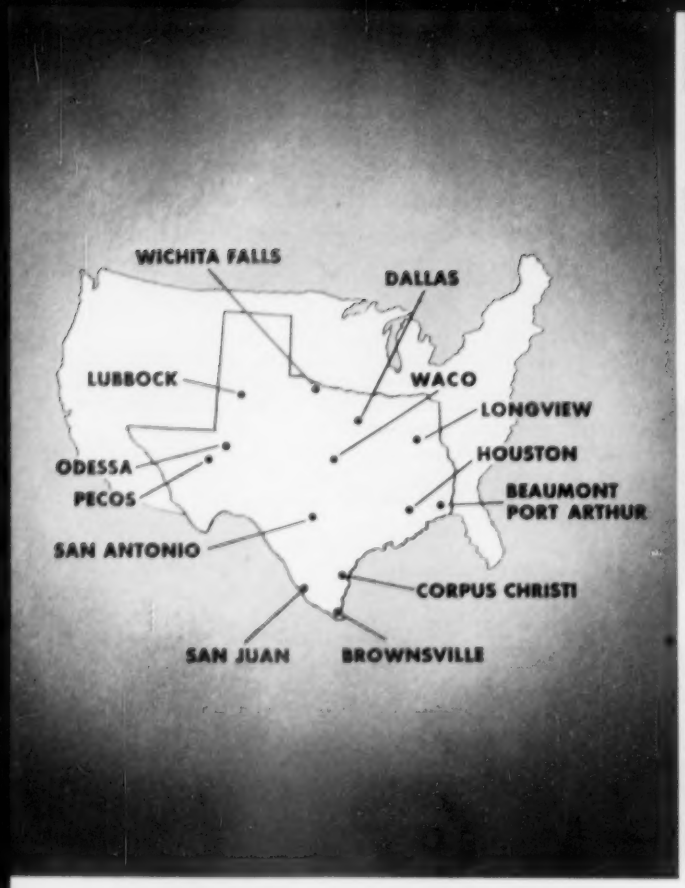
EFFECT OF AROMATICS on surface ignition. Fig. 8.



EFFECT OF SULFUR on octane benefit for various gasoline stocks. Fig. 5.



EFFECT OF SULFUR on the boron compound response of virgin naphtha. Fig. 6.



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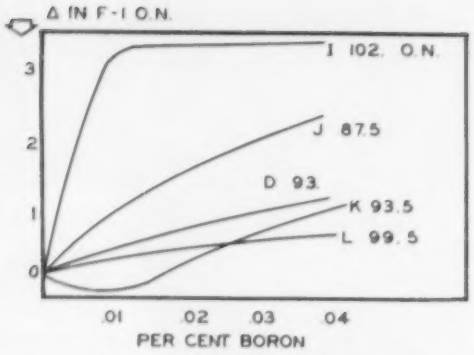


OCTANE EFFECT of boron in gasolines. Fig. 9.

the antiknock effect of the boron compound to octane level, per se, have not been successful.

Effect in typical gasoline blends and stocks . . . The effect of the boron compound in some typical gasolines, as shown in Fig. 9, illustrates that octane level itself is not the determining factor. Thus the top curve is a 102 O.N. (G.M. convention octane numbers) fuel that has a 3.3 octane number increase (that is up to 105.3 O.N.), with a relatively small (0.01 per cent) boron concentration. On the other hand is the 99.5 O.N. fuel that was increased but 0.6 O.N. to 100.1 O.N. Two other gasolines of 87.5 and 93 O.N. lie in between the extreme types in this figure, to emphasize the independence of the antiknock effect from octane level.

In Fig. 9 an unusual curve is shown for a 93.5 O.N. high aromatic fuel. The negative effect on octane number at lower concentrations of boron is typical of such gasolines. At higher boron concentrations the antiknock effect is again observed as in this case where it rises to 0.8 O.N. at 0.03 per cent B. The peculiar effects arise from the blends that are used. In Fig. 10 is shown the antiknock effect of the boron compound in a number of refinery streams. Light straightrun naphtha is very responsive. At the other extreme are highly aromatic catalytic reformates that give a negative response up to 0.04 per cent B. Between these lie thermal reformate and catalytic distillate. Fig. 11 shows that alkylate and polymer are very responsive to lower concentrations of boron; the response then levels out. However, it is shown that when blended with other stocks such as light virgin or catalytic cracked distillate, the response at higher boron concentrations is good. A blend of 30 per cent poly in straightrun reached 93.1 O.N. with 0.02 per cent of boron, the last 3.4 octane numbers being supplied by the boron compound. Thus an investigation of boron compound's antiknock value needs to be made at several levels for each type of gasoline in order to estimate its utility.

Fourth cc. of TEL . . . One way to look at the use of the boron compound is to consider it as a permissible antiknock replacement for that fourth cc. of TEL we cannot now use. Table 3 shows this concept for three types of possible gasoline blends. The hypothetical fourth cc. of TEL could be replaced by 0.008 to 0.022 per cent B. In each case the last 1 to 1½ octane number (so difficult to squeeze out in refining) was contributed by the boron compound.

The boron compound's antiknock effect can be used by the refiner in still another way. The virgin naphtha content of a gasoline can be increased with no loss in antiknock level. The more boron compound used, the more such additional naphtha can be utilized in gasoline formulation. Four examples of this are shown in Table 4. Fuel C was a regular gasoline of 89.7 O.N. It already contained 25 per cent of a light virgin naphtha of 8.6 O.N. (3 cc. TEL). It was possible to hold the octane number constant while adding up to 16 per cent more virgin naphtha by using the antiknock effect of 0.02 per cent B. Even Fuel F of 99.3 O.N. could absorb more virgin naphtha with the aid of the boron compound. For example, 5.2 per cent more naphtha was added and 0.01 per cent B used to keep the octane number at 99.3.

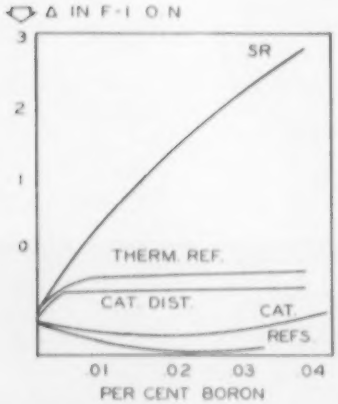
TABLE 3—BORON CONTENT TO EQUAL FOURTH CC. OF TEL PER GALLON

	Δ in O.N., fourth cc. of TEL per gal.	Per cent B to equal fourth cc. of TEL
Fuel D—94 O.N. straightrun-catalytic distillate	1.3	0.016
Fuel E—96 O.N. straightrun-alkylate	1.45	0.008
Fuel F—99 O.N. straightrun-catalytic distillate-alkylate	1.10	0.022

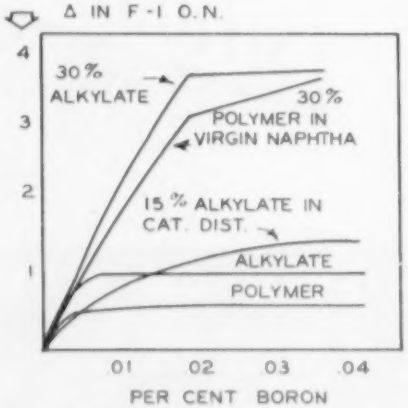
TABLE 4—THE USE OF MORE VIRGIN NAPHTHA IN GASOLINE BLENDING AS MADE POSSIBLE WITH THE BORON COMPOUND

Fuel (3 cc. TEL)	Initial content virgin naphtha	Octane No.	Additional virgin naphtha† possible at various conc. of boron* 0.004% B	0.01% B	0.02% B
C	25	89.7	5	12	16
D	21	93.1	2	6.3	9.4
A	20	95.0	2	6	9
F	5	99.3	3.7	5.2	7

*O.N. maintained constant. †O.N. is 80.6 (Fuel B, Table 7).



OCTANE EFFECT of boron on refinery gasoline streams. Fig. 10.



OCTANE EFFECT of boron in various gasoline blends. Fig. 11.

Relation Between F-1 and Road Ratings

The antiknock effect of the boron compound found by the F-1 is regularly found in standard road testing

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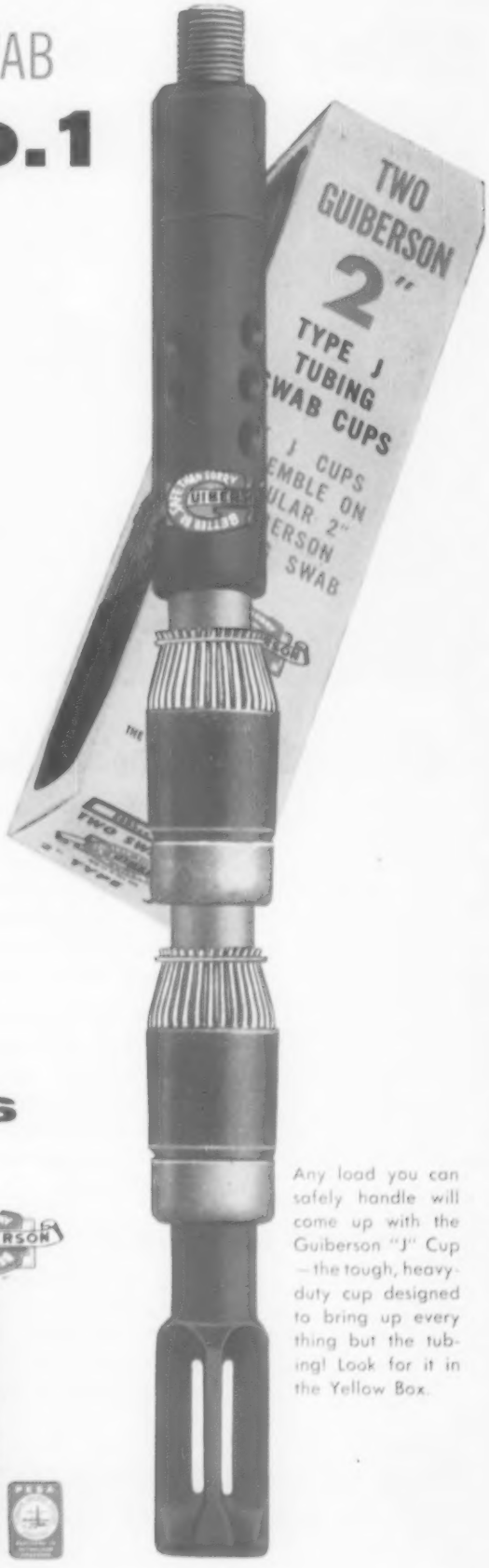

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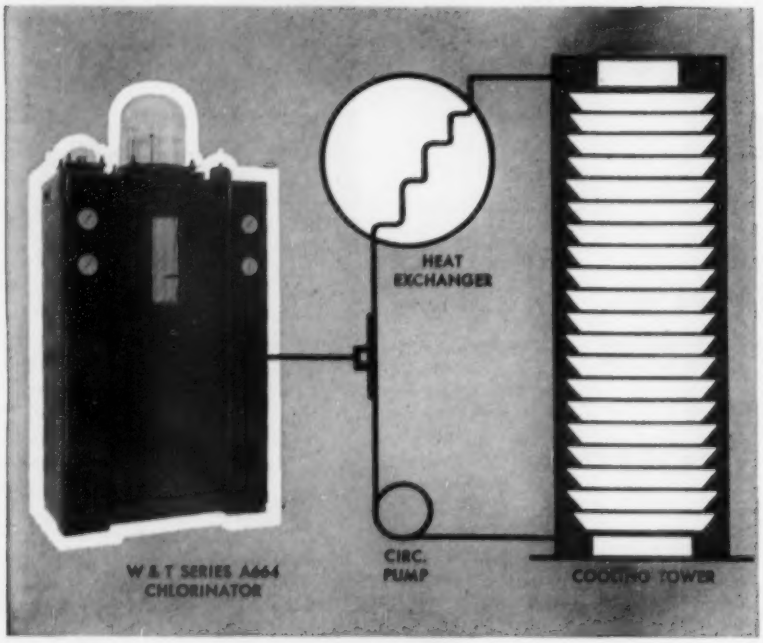

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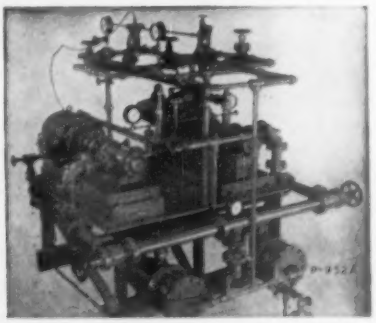

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of our refinery products. Table 5 shows, however, that differences do exist among cars. Thus the 1955 Cadillac "found" the F-1 predictions on the road better than did the 1955 Chevrolet. For example, with the 95 O.N. Fuel A, the Chevrolet found just slightly more octane increase than the F-1 did. However, the Cadillac found a whole octane number where the F-1 predicted but 0.3. On the other hand, the boron compound in the commercial Fuel H of 90 O.N. was appreciated by the Chevrolet as well as the Cadillac. In the 1955 Buick, an experimental low-aromatic Fuel F showed a direct correlation, but a high-aromatic Fuel G showed a substantial appreciation on the road over the boron compound's contribution to F-1 octane number. In fact, the negative finding in the F-1 was turned into a positive improvement of up to 0.8 O.N. on the road. These observations may reflect the fact that the boron compound is particularly good in sensitive engines. Thus the F-1 is much more appreciative of it than the F-2. Also, in the F-4 it usually becomes quite proknock in its action.

"One way to look at the use of the boron compound is to consider it as a permissible antiknock replacement for that fourth cc. of TEL we cannot now use. The hypothetical fourth cc. of TEL could be replaced by 0.008 to 0.022 per cent boron."

TABLE 5—EFFECT OF THE BORON COMPOUND ON F-1 AND ROAD OCTANE

Fuel	Per cent B	F-1 Octane No.	Increase in F-1	—Increase in road octane number— 1955 Chev.	1955 Cad.	1955 Buick
A	0	95				
	0.004		0.3	0.4	1.0	
	0.02		1.0	0.5	1.2	
C	0	90				
	0.004		0.95	0.7	0.9	
	0.02		1.5	1.1	1.15	
H	0	90				
	0.004		0.3	0.5	0.9	
	0.02		0.85	1.0	1.1	
F	0	99				
	0.004		0.45			0.7
	0.01		0.85			0.8
	0.02		1.05			0.8
G	0	98				
	0.004		—0.15			0
	0.01		—0.10			0.4
	0.02		—0.05			0.8

TABLE 7—FUEL PROPERTIES

Fuel—	A	B	C†	E	F	G	H	I	J	K	L
F-1 O.N.*	95	80.6	89.7	96	99.4	98.6	90	102.5	87.5	93.5	99.7
Distillation:											
I.b.p.	126	100	113	107			96	105	92	94	99
10 per cent	166	139	144	150			136	160	123	130	121
50 per cent	240	196	221	205			235	219	230	206	177
90 per cent	387	238	354	252			360	253	321	280	327
End point	442	291	425	320			430	328	354	344	344
Per cent sulfur	0.047	0.027	0.040	0.015				0.016			
Composition, per cent:											
Virgin naphtha	20	100	25	40	5	20	27	6			
Cat. naphtha	80		30		80		30				
Therm. reformate			40				40				
Cat. reformate						80					
Polymer			5				1				
Alkylate				60	15		2	94			
Paraffins	35	66	41	85	47	36		98	38	50	33
Olefins	24		18	1.5	16	8	1	0.8	0	0	35
Naphthenes	20	32	29	12	14	6		0	44	19	8
Aromatics	21	2	12	1.5	23	50	13	1	18	31	23

*TEL varies from 2.6-3.0 cc. per gal. †Fuel D like Fuel A but 93 O.N.

TABLE 6—EFFECT OF THE BORON COMPOUND ON F-1 OCTANE NUMBER

Fuel	F-1 O.N. 0% B	0.04% B	0.012% B
1	98.5	98.9	99.3
2	97.0	97.1	97.2
3	96.8	97.0	97.3
4	97.5	97.8	98.0
5	97.8	98.0	98.0
6	98.0	98.4	98.4

The increase in road octane number shown in Table 5 is statistically significant at well above the 95 per cent confidence level.

Texas Gasolines

We also checked the antiknock response of a number of Texas premium gasolines to our boron compound. All six fuels showed an increase in F-1 octane number as shown in Table 6. In addition, all six showed an increase in road rating in the one car used.

Summary

The boron compound tested as a component of gasoline will not only reduce combustion zone deposits and surface ignition but will help the refiner to meet his antiknock specification. By using it for that purpose he will also improve his chance of avoiding knock complaints from the surface-ignition-induced wild ping.

Acknowledgments

The authors acknowledge gratefully the contributions to this work of R. C. Tupa and L. Szabo, of the chemical and physical research division; G. Scott, of Cleveland refinery control laboratory; R. Fell, H. F. Hostetler, W. R. Tuuri, and D. B. Albrecht, of the automotive engineering division; J. M. Dempster, of Commercial Research Development; and E. J. Powers, of process and product development laboratory.

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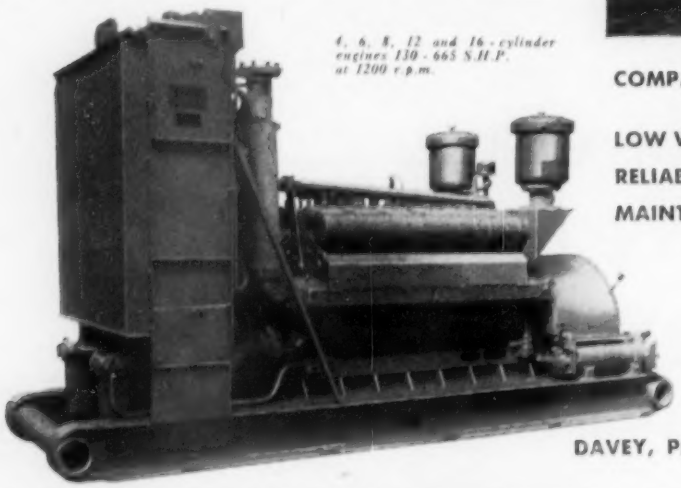

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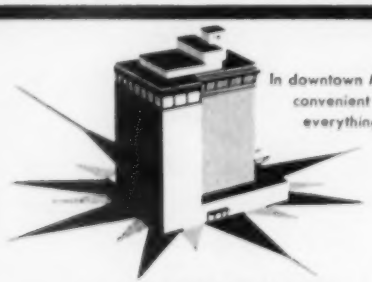

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Mud drilling was uneconomic, so Tuley turned to . . .

Air Drilling at Shallow Depths

by Ralph Hague, Jr.

MUHLENBERG County in western Kentucky, is uneconomical for conventional mud drilling with rotary tools; therefore, cable tools predominate in Muhlenberg, Todd, and Christian counties. The general absence of water-bearing formations, much as in the Appalachian basin, makes this area excellent proving grounds for rotary air drilling at shallow depths. A majority of the locations start off in the Kincaid limestone and at least 60 per cent of the total hole is limestone.

To date, W. R. Tuley Drilling Co., of Evansville, Ind., has completed three wells in Muhlenberg County—two with air and one with air and water. No efforts have been made to dig a rathole due to surface formations; however, standing kelly back in the derrick has not been found undesirable. Surface hole is cased with 20 to 30 ft. of 10¾-in. casing; the depth is dependent upon surface waters encountered. This portion of hole is cut without benefit of dust deflector and rotating head is installed on surface casing while cement is setting.

From under surface pipe, hole is reduced to 7⅞ in. and with 3½-in. drill pipe a return velocity of 3,000 ft. per minute is maintained. Some shale formations cut so fast it has been necessary to stop and blow the hole in order to deliver these larger cuttings to the surface.

The first well was drilled with air from 0-857 ft. using only one 6¼-in. drill collar. Penetration rate was 8.10 ft. per hour. Three new bits were used and all three were pulled green.

Pay section was encountered at 848 ft. and producing sand was penetrated 9 ft.; however, due to temperature of input air the light hydrocarbons were driven from the oil causing a gummy cake to form on the bit. This in turn picked up particles of sand, forming a ball around the bit and which stuck the bit when starting out of the hole. Considerable time and effort were spent trying to get loose without resorting to fluid and pump pressure; however, pump pressure at 1,200 psi. broke through.

The second well was drilled with air from 0-432 ft. at which point the bit stuck, due to a balling effect of the cuttings caused by a "weeping water" formation. These weeping formations tend to make a putty consistency of the cuttings. This necessitated changing over to water and mud pump. Hole was completed in this manner from 432-862 ft. This hole used three new 7⅞-in. bits. Penentration rate was 10.23 ft. per hour.

The third well was drilled with air from 0-1,057 ft., cutting 7⅞-in. hole using one used bit from 0-340 ft. and one new bit from 340-1,057 ft. Seven 5½-in. and one 6¼-in. drill collars were used putting 19,000 lb. on the bit at 240 ft. With this added weight on the bit, penetration rate was increased to 19.35 ft. per hour. Suggested weight on bit has been 3,000 lb. per inch of diameter, and experience has shown this is not excessive, in fact additional weight is desirable unless crooked-hole tendencies develop. Since drilling depths are shallow in this area, a pull-down device will be tried in the near future to achieve more weight on the bit.

The producing formations in this area are relative low-pressure zones which also give air drilling a decided advantage over fluid in that the hydrastatic head of the fluid column is not blocking possible producing zones, thereby lending better and cheaper completion costs. On the third hole mentioned, a break in the St. Genevieve limestone was encountered at 1,053 ft., and after drilling 4 ft. the well began to flow a 2-in. stream of oil. Compressors were shut down and flow stopped.

Bit life has been phenomenal where air alone is the media for returning cuttings. Medium-hard formation bits with air courses to the bearings have given best over-all performance. Not a single bearing failure has occurred.

Gas has been encountered on two holes; therefore, a pilot light burns continuously at end of "blooey" line. This pilot is lighted prior to entering this zone and remains lighted until well is completed.

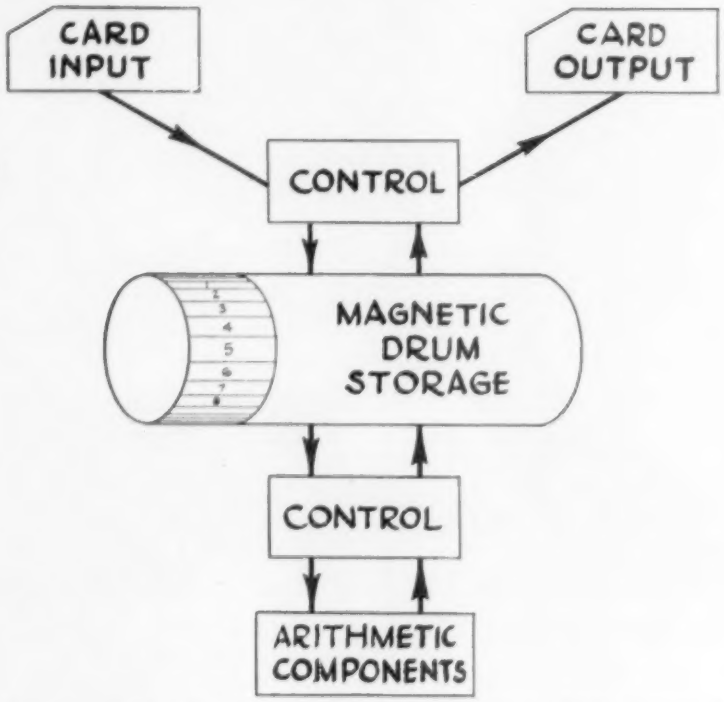
Pressure requirements have remained almost constant at 80 psi. using one LeRoi stationary type compressor capable of delivering 710 cu. ft. per minute at 120 psi. Maintenance requirements to date on this type compressor have been absolutely nil. The only repairs on rotating head have been replacement of kelly packoff rubber. The most efficient rate appears to be 50 to 60 r.p.m. rotating speed of the table.

The author is air drilling engineer, Tuley Drilling Co., Evansville, Ind.

Take the drudgery out of pipeline design calculations . . .

Magnetic-Drum Electronic Computer Is Brain Saver

by H. E. Thomas



BASIC ELEMENTS of the magnetic drum electronic computer, showing sequence of their use. Fig. 1.

Electronic computers lend themselves to pipeline design by eliminating many tedious and repetitious manual calculations. Initial programing of the computer actually takes more time than if the calculations were done manually. But once set up, parameters can be changed easily and performance of an entire line calculated in minutes.

ABILITY of an automatic digital electronic computer to perform hundreds of arithmetic and logic operations per second makes it a very efficient tool in solving complex mathematical or engineering problems. Whether or not a tool of such high caliber should be applied to any specific task depends both upon the speed and accuracy required for the results as well as with the frequency the problem is performed. The purpose of a computer, then, is to perform both mathematical and logical applications at tremendous speeds without the element of human error entering into the computations.

To comprehend use of a computer it is necessary to have some understanding of the basic elements of the computer's physical units. A computer of any type consists of five basic elements:

1. Input
2. Arithmetic unit
3. Storage
4. Control
5. Output.

Even a standard desk calculator may be considered analogous to an electronic computer in these five categories. The input is the keyboard, the arithmetic unit is the internal mechanism, the storage is either the operator's brain or the paper on which the results are written, the control lies with the operator, and the output is in the dials.

Author is with El Paso Natural Gas Co., pipeline design section. Paper presented in Dallas before the committee on pipelines, construction division, American Society of Civil Engineers.

PIPELINING

The specific type of computer I am concerned with here differs primarily from any other type of electronic computer in the characteristic of its storage facility. The storage of this type computer is a magnetic drum, see Fig. 1. This is a cylinder with a sheet of magnetic material wrapped around its surface. When this drum turns, bits of information in the form of current pulses can be recorded as magnetic spots in the surface of the drum. Information is recorded as a coded, 10-digit number, with associated sign, referred to in computer terminology as a "word." This word may either be data information or an instruction operation code, which the machine has been designed to interpret as some arithmetic or logic operation.

Each word may be recalled from drum storage for usage at any time or may be replaced by new information at any time. Each word is retained on the drum until a new word is recorded in its place. Computers designed by different manufacturers have varying capacities as to the number of words which may be recorded on the drum, the general capacity being between 1,000 and 2,000.

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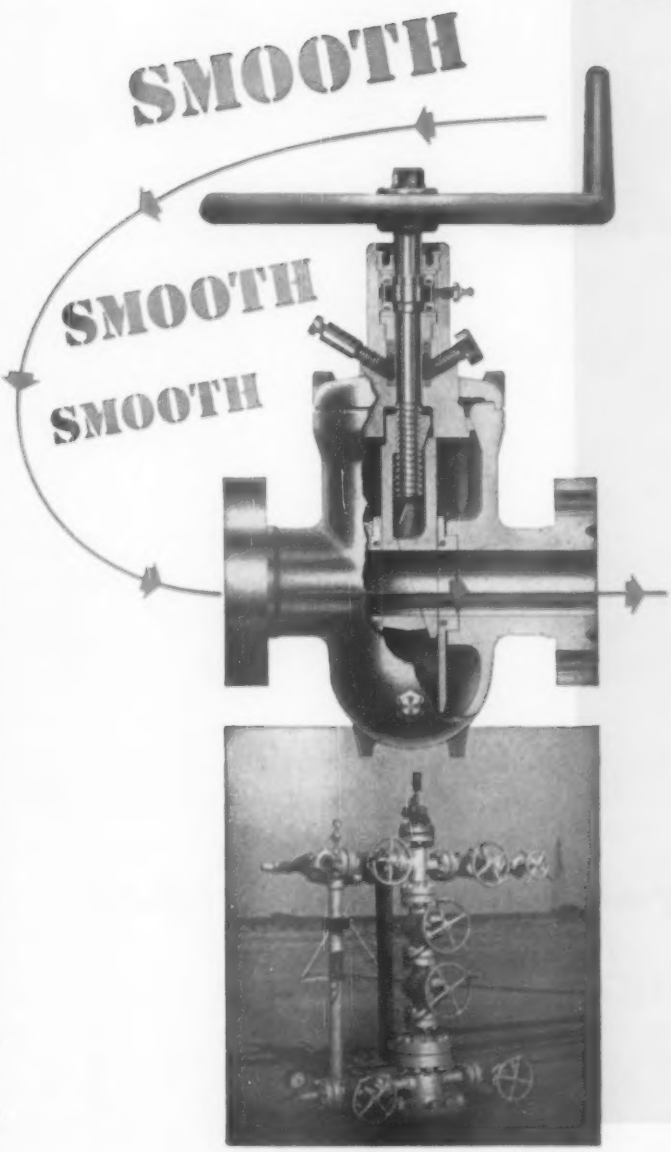

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a computer facility is "programing." Programing is the breaking down of a problem or formula into its simplest arithmetical and logical steps.

After the problem is broken down, the programer must code them into the language of the machine. Before programing is started, a careful analysis of the problem must be made. The objective of the problem, the limitations of the available computing equipment, how information is to be given, and how results are to be presented must all be very carefully considered.

The programing of a problem generally requires more time than it would take to perform the computation manually. For this reason, a calculation to be used as a computer application must be one that is to be repeated many times. The variables or parameters may change for each calculation, but the basic computational procedure must be repetitious. A program can be programed with varying degrees of efficiency. More programing time is required to obtain optimum computing speed. Whether or not this additional time should be used depends on the frequency of computation.

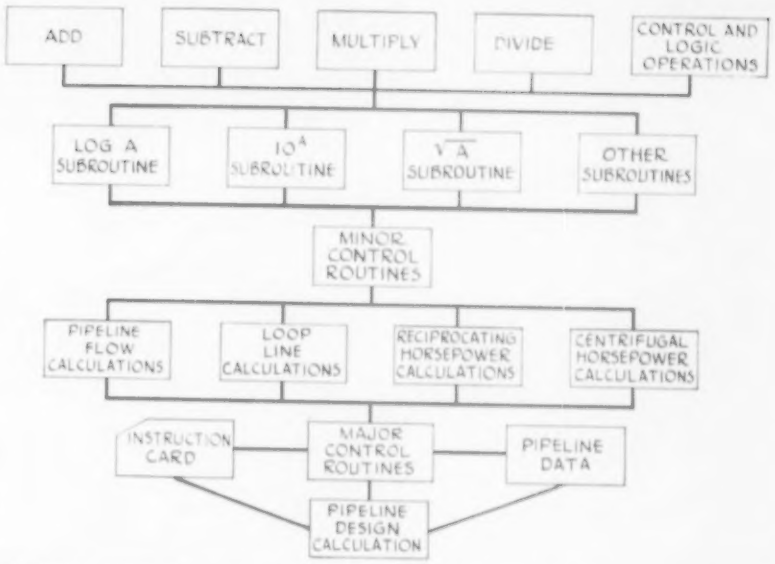
In September 1955, El Paso Natural Gas Co. placed in operation an I.B.M Type 650 magnetic drum data-processing machine. This machine has a drum storage capacity of 2,000 words.

One of the first problems considered was that of pipeline design. It was desired to eliminate as many of the tedious manual calculations as possible to give pipeline design engineers more time to study the problem from an engineering standpoint. It was also desired to program into the machine as much control as possible, so the machine would be able to make simple decisions to keep the design within limits specified by the design engineers.

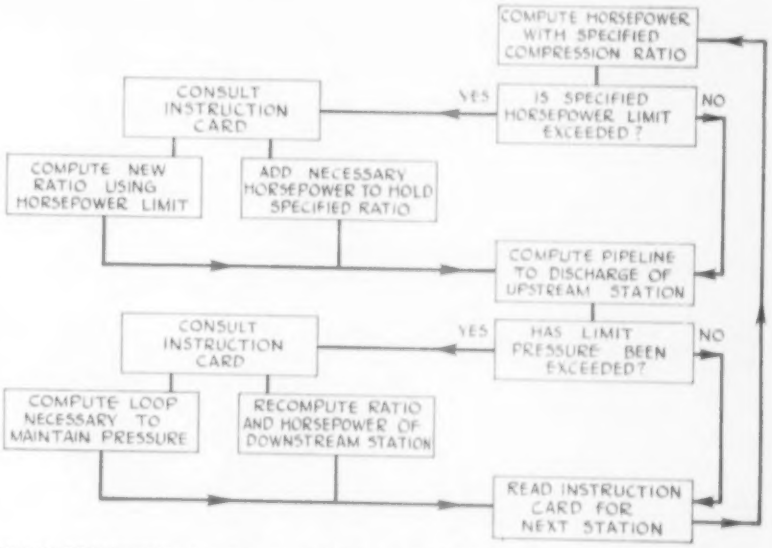
A modified Panhandle Eastern flow equivalent is employed to compute pressure loss between points in the pipeline system. This flow equation involves numbers to fractional powers and square roots, in addition to the simple arithmetic operations such as addition, subtraction, multiplication, and division.

These basic operations are built into the machine as standard codes. This made it necessary to program such subroutines as logarithm of A, 10 to the A power, and square root of A, using the four basic arithmetic operations as building blocks to obtain the desired results. These three subroutines along with other subroutines needed in the calculations required about 300 words of drum storage.

Using these programed subroutines as additional tools it was possible to program all the primary routines needed for the calculation of a pipeline system, see Fig. 2.



IN PROGRAMING the computer for a pipeline-design problem, data and instructions shown here must be supplied manually. Fig. 2.


COMPUTE HORSEPOWER WITH SPECIFIED COMPRESSION RATIO
IS SPECIFIED HORSEPOWER LIMIT EXCEEDED?
YES
NO
CONSULT INSTRUCTION CARD
COMPUTE NEW RATIO USING HORSEPOWER LIMIT
ADD NECESSARY HORSEPOWER TO HOLD SPECIFIED RATIO
COMPUTE PIPELINE TO DISCHARGE OF UPSTREAM STATION
HAS LIMIT PRESSURE BEEN EXCEEDED?
YES
NO
CONSULT INSTRUCTION CARD
COMPUTE LOOP NECESSARY TO MAINTAIN PRESSURE
RECOMPUTE RATIO AND HORSEPOWER OF DOWNSTREAM STATION
READ INSTRUCTION CARD FOR NEXT STATION

LOGIC FUNCTIONS, i.e., "yes or no" steps, control the computer as it proceeds through a design problem. Fig. 3.

What the Computer Does

The pipeline flow calculation computes the pressure loss due to friction between points along the pipeline and also adjusts this pressure with static head conditions effected by the differential elevation between the two points. This routine was programed in such a manner as to be effective whether computing counterflow or in the same direction as the gas flow. This primary routine required approximateiy 185 words of drum storage, as well as the incorporation of all the subroutines previously programed.

The loop-line calculation uses the same modified Panhandle Eastern flow equation but varies the parameters. Purpose is to compute the number of miles of pipeline of specified size paralleling the existing system to meet pressure conditions between two points on the pipeline. These pressures may have been computed on a previous calculation pass or may have been specified at the beginning of the problem. This routine requires approximately 140 words of drum storage.

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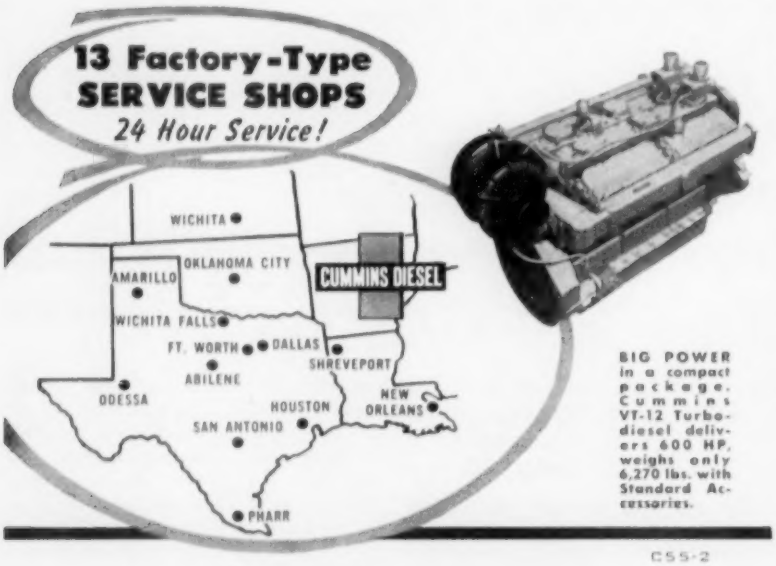

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cal polynomials have been derived for the horsepower vs. compression-ratio curves for a reciprocating compressor engine. Using these polynomials and a computed or specified compression ratio, this routine computes horsepower requirements at a reciprocating compressor station. The fuel used is computed and added to the flowing volume on the discharge side to give flowing volume on the suction side of the station. The centrifugal horsepower formula was programed in the same manner to obtain the horsepower and fuel requirements at a centrifugal compressor station. These routines required approximately 280 words of drum storage.

Design kept within limits . . . Control routines are needed to integrate the usage of these calculation routines. These routines also check the computations at various points to ascertain if the system is still within specified limits. At any time a limit is exceeded the machine will either consult an instruction card to determine in what manner to proceed, or in the case of a predetermined decision, will proceed as had been specified in the program. Fig. 3 shows these steps. These routines control the output of the completed results into punched cards. All control routines require approximately 250 words of drum storage.

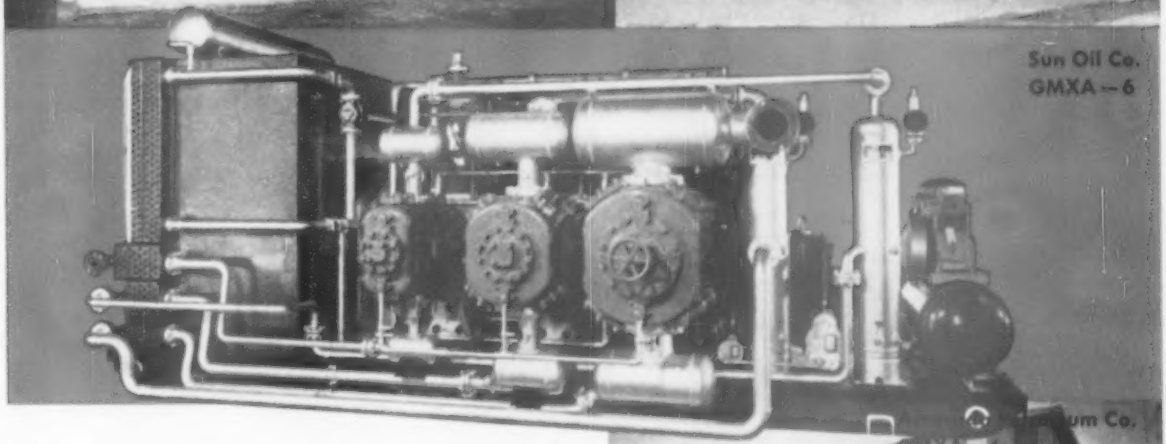
Storage of Line Data

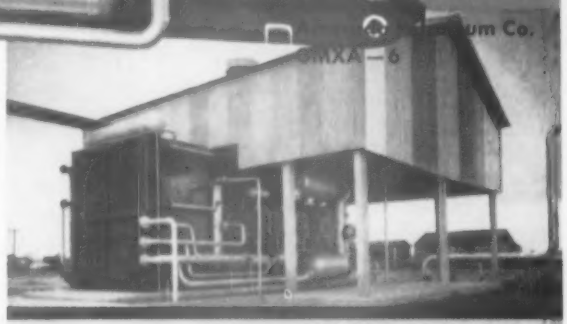
The programing of all these routines fills approximately 1,300 of the 2,000-word capacity of the drum. This leaves 700 words available for pipeline-data storage. These 700 words were divided into seventy 10-word blocks. Each point on the pipeline where a pressure computation is required such as a takeoff volume point or elevation correction point, uses one of these blocks.

The data which must be supplied for each point are pipeline code, milepost, elevation, pipe data, allowable working pressure of pipe, and tap volume. In addition, two words must be left open for the computed pressure and volume of gas flowing through that particular line section.

Each compressor station, whether reciprocating or centrifugal, requires two of these 10-word blocks of data. Data which must be specified are milepost, elevation, discharge pressure limit, installed sea-level horsepower, pipe data, horsepower elevation correction, tap volume, and compression ratio. Data computed to fill in the blocks are brake horsepower, discharge pressure, volume compressed, sea-level horsepower required, suction pressure, and fuel.

One block is used for the input of initial flow conditions (pipeline efficiency, specific gravity, flowing tem-





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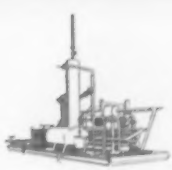

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perature, and pressure base). Each time any one of these factors changes along the pipeline a new block is required. A typical pipeline might consist of 59 line section points and 5 compressor stations with the flow-conditions block completing the 700 available words (seventy 10-word blocks) to fill the entire drum to capacity.

More control by card . . . With the drum filled to capacity, the only means of exercising any further control is by an instruction card (see Fig. 3). An instruction card is read by the machine each time the computation, proceeding counterflow, reaches the discharge of a compressor station successfully and is within specified limits.

This instruction card, prepared previous to the computation by the design engineer, is effective then for the compressor station just reached and the pipeline upstream to the discharge of the next station. In case the specified compression ratio of the station required more horsepower than has been specified, the instruction card is consulted to see if additional horsepower is desired to maintain this specified ratio or if a new ratio should be determined from the specified installed horsepower or horsepower limit. The station computation can then be completed.

The pipeline flow calculation then proceeds and computes pressure along the pipeline to the discharge of the upstream station. When the point on the discharge of the upstream station has been computed, the machine checks to see if the allowable working pressure or discharge limit pressure has been exceeded at any point on the pipeline in that section. If the pressure has been exceeded the instruction card is consulted. This card specifies whether loop line should be added to that section or a new suction pressure computed at the downstream station and horsepower added.

If loop line is desired, the design engineer must specify, on the instruction card, the milepost where loop is to start and the pipe size of the loop line to be added. The machine then makes a direct flow run and a counterflow run as specified on the instruction card to pull conditions in that section within specified limits.

Procedure in Using Computer

To run a complete pipeline study, the first step is to load into the drum from cards, the 1,300 words of programed calculation instructions. At the full card reading rate of 200 cards per minute and four words per card, this loading takes about 1 minute and 40 seconds.

The second step is to load the pipe-

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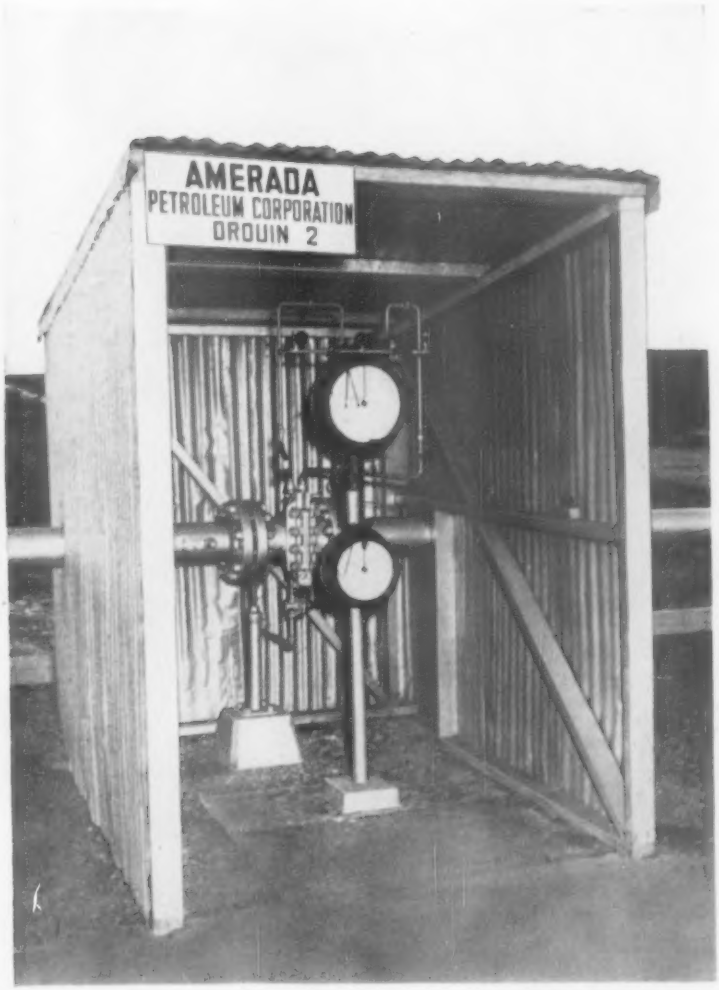

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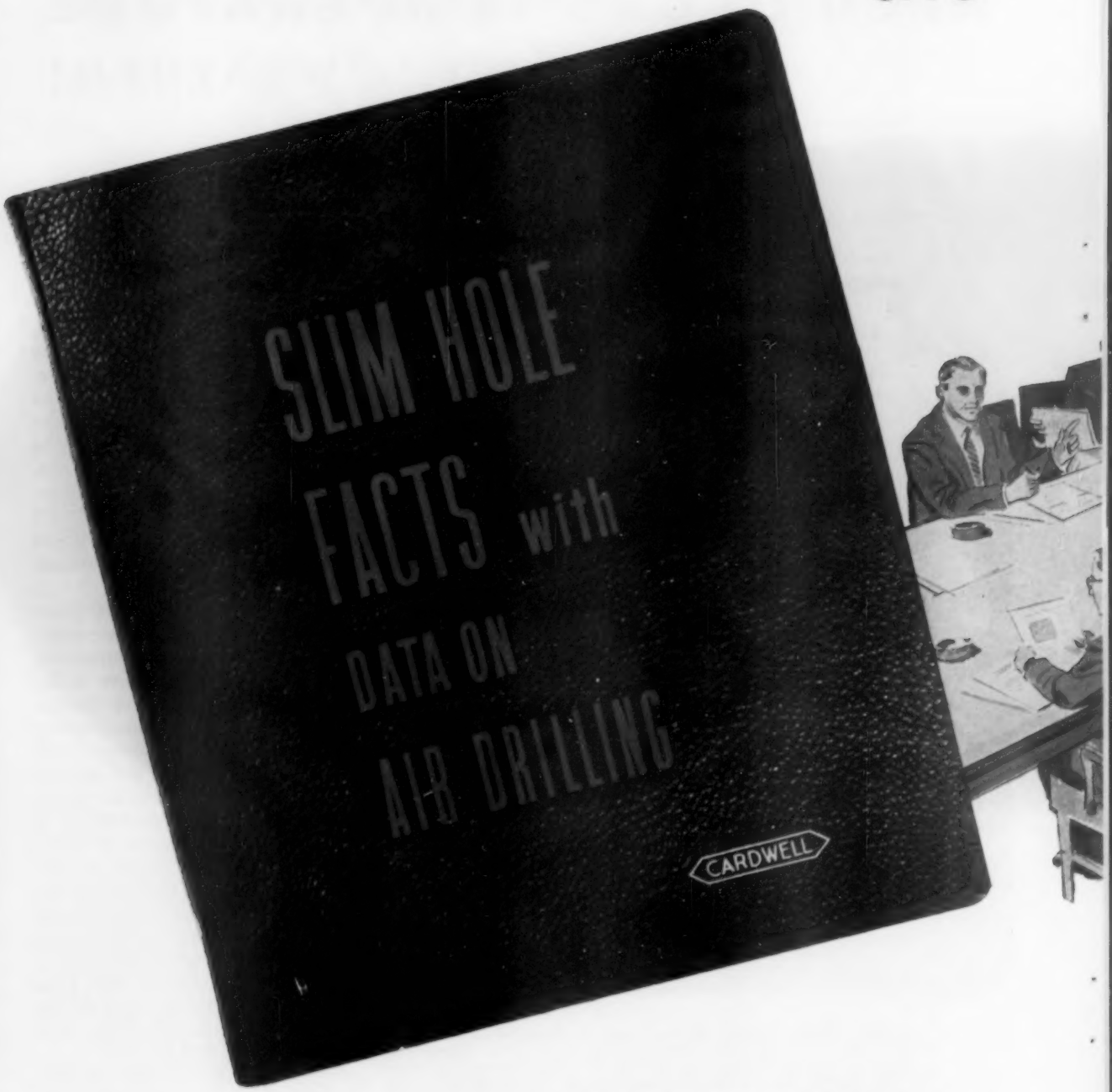

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Recognizing the importance of this trend, Cardwell has prepared this book, "Slim Hole Facts with Data on Air Drilling" as an aid to producers and drilling contractors who are considering these two important techniques. For your free copy, write Philip McLaughlin, Director of Drilling Research, Cardwell Manufacturing Company, on your company letterhead.

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line data. One card has the full information for one data point to fill one of the 10-word blocks. Since 70 of these blocks is the maximum number allowable, loading pipeline data could not take more than 21 seconds.

The pipeline data cards are followed by cards specifying starting pressure and volume conditions. The instruction cards prepared by the engineer are placed in the input card feed to be consulted as the computation progresses up the pipeline. The computing time, then, varies depending upon the number of line sections and the computations necessary to stay within the limit conditions specified.

At the conclusion of the calculation, all data, complete with pressures, volumes, required horsepower, fuel, and other necessary items are stored on the drum. The punch-out routine then becomes effective and punches these results into cards. The resulting punched cards are run through a tabulating machine which prints the results in the form required by the design engineer. Any subsequent pipeline studies may be calculated without loading the programed calculation instructions, since these remain on the drum until replaced by different type calculations.

A typical mainline study required about 10 minutes computing time. This same study done manually would take one man about 2 weeks. Of course considerable time is required to lay out the pipeline in the manner required by the computer. For existing pipelines, however, this layout can be performed once and is valid until loop line or horsepower is added. When this is done, minor modifications to the layout data keep it up to date. A proposed or new line must be laid out completely, with surveyed mileposts and elevation given. This type of layout should require approximately an hour and a half for one man.

This computing facility is a tremendous aid to the pipeline design engineer. It eliminates complex manual computation with its chances of human error, giving more time for engineering thought. Its speed allows making many difficult studies to select the most desirable design.

Only the application of a computer to the design of a gas-transmission line has been considered here. Liquid products and water pipelines might be applied in a similar manner. In addition, the transformation of pipeline survey notes to coordinate data is another machine application. Any computational problem which is repetitious in nature might be a computer application, giving more time for creative engineering.

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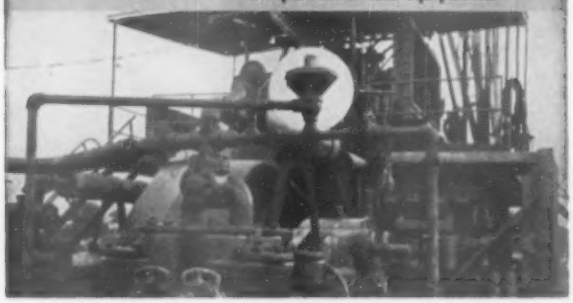

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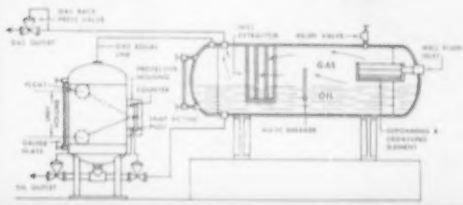

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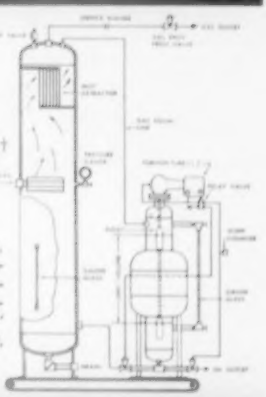

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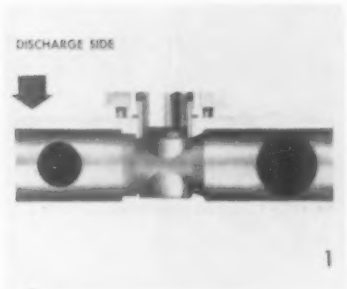
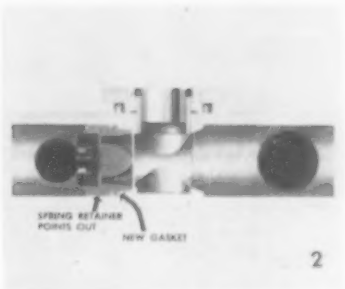
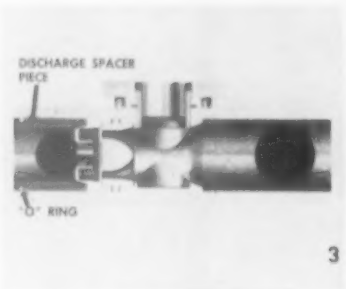
How to Install and Maintain Power Pumps—7



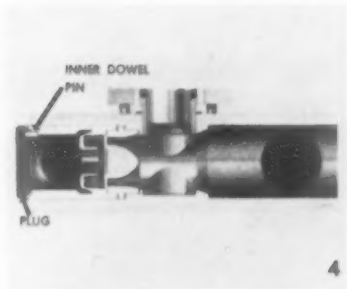
54 To put double-ported valve assemblies back in a pump, start with the discharge valves.



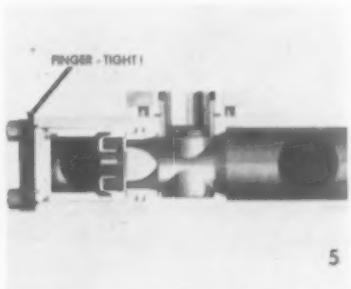
55 Insert the new gasket all the way, and then add the assembly with the spring retainer pointing out.



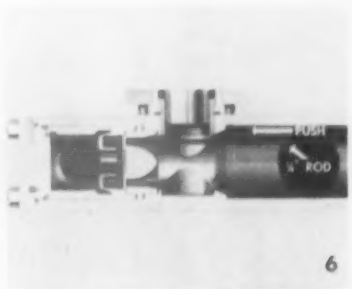
56 Put in the discharge spacer piece with the notch on the outer end and on top. Insert the "O" ring.



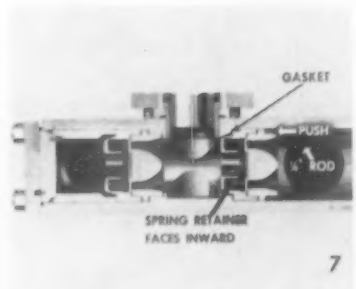
57 Replace the plug, bevel side in, with the inner dowel pin engaging the spacer notch.



58 Bolt on the cover, finger-tight. Note that the top is marked to assure proper placement.

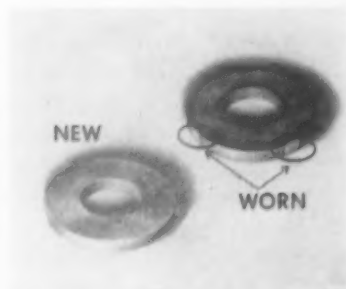


59 Push a quarter-inch rod from the suction side through the ribs in the discharge valve seat.



60 Suction valves go in the same way, except that the spring retainer faces inward.

61 Tighten the cover studs, then retighten after starting and check tightness periodically.



62 Three months after starting, check and replace valves that show signs of wear.

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BETHLEHEM STEEL

9. Cost of Brick, Cement, and Clay Products

by W. L. Nelson
Technical Editor

THESE common materials are the basis of many detailed cost estimates. The costs of various items used widely in the construction of furnaces, boiler settings, etc., are shown in Table 1. Pipe costs are shown in Table 2. Labor costs in laying pipe vary widely but in general they are about 15 cents per foot for small pipe that is joined by cementing. In the larger sizes (18-in. and larger), however, the pipe is so heavy that it must be handled with a frame or equal methods. Thus, three men might lower the pipe into a trench with an A-frame. This nearly doubles the cost. The cost of digging trenches, etc., on a small scale is indicated in Table 3.

TABLE 1—APPROXIMATE COSTS OF BRICK, TILE, AND BOARD, 1946
(Mainly for furnaces, boiler settings, etc.)

	Unit	Costs: Material	Labor	M. & L.
Brick (stills or boilers):				
Common or red[1]	$/M	18-24	45-55	65-75
Fire clay[1]	$/M	58-73	60-75	115-145
Insulation[1]	$/M	136-158	60-75	190-223
Paving, 3-in.	$/M	41-55		
Special brick (f.o.b. plant):				
Sand lime	$/M	19.3		
Silica[2]	$/M	61-63		
Alumina (high)[3]	$/M	97-420		
Magnesite (basic)	$/M	440-490		
Magnesite (basic)[4]	$/ton	90		
Chrome	$/M	320-350		
Chrome[4]	$/ton	63		
Cement building block[5]	ct. each	15.6		
Tile (still or boiler):				
Flat roof, suspended, 10-in.	$/sq. ft.	2.90	2.30	5.20
Curved arch, suspended, 8-in.	$/sq. ft.	3.10	2.50	5.60
Tile (miscellaneous):				
Hollow, building[5]	ct. each	9.5		
Floor, standard[6]	$/sq. ft.	0.23		
Wall, white, glazed[6]	$/sq. ft.	0.27		
Board:				
Asbestos cement, ¼-in. flat	$/sq. ft.	0.26	0.10	0.36
Asbestos cement, ½-in. flat	$/sq. ft.	0.50	0.17	0.67
Asbestos cement, ¼-in. corrugated	$/sq. ft.	0.27	0.10	0.37
Black panel, 42 x 48 in., ¼-in.[7]	$/sq. ft.	0.95		
Black panel, 42 x 48 in., ½-in.[8]	$/sq. ft.	1.23-1.40	0.65-0.83	1.83-2.13
Plaster board, buildings	$/M sq. ft.	33.77		
Insulation board, buildings, 48-in.[9]	$/M sq. ft.	18.46		
Mortar or cement:				
High temp. for fire clay[10]	ct./lb.	4.5-5.5		
Insulation (brick)[11]	ct./lb.	5.0-6.5		
Wall wash for seal[12]	ct./lb.	9	8.5	17.5
Plastic fire brick or clay[13]	$/ton	58		
Refractory block[14]	$/sq. ft.			10-12
Refractory, gunited on wire mesh	$/sq. ft.			3.10
Insulation aggregate behind headers of stills, etc.[15]	ct./lb.	6		
Asbestos rope for expansion joints[16]	ct./lb.	36-39	8-9	44-48
Asbestos rope for expansion joints	ct./ft.	11.5		

Notes: (1) 18 brick per cu. ft.; (2) carload lots; (3) price increases with alumina content (50-80 per cent); (4) special shapes; (5) 8 by 8 by 16 in., f.o.b. plant; (6) f.o.b. factory; (7) instrument panel (8) instrument panel f.o.b. cars; (9) f.o.b. cars; (10) 400-500 lb. for M fire brick; (11) about 75 lb. for M brick; (12) about 250 lb. for M sq. ft. wall; (13) joints, curves, fillets, etc.; (14) for towers or stacks (to 1,100° F.); (15) 4.5 lb. per sq. ft. header; (16) about 30 lb. per MM, B.t.u.

TABLE 2—MATERIAL COST OF DELIVERED CEMENT AND TILE PIPE (1946)

Pipe size, (in.)	Vitrified clay, $/ft.	Concrete, $/ft.	Concrete, reinforced $/ft.
4	0.22		
6	0.31*		
8	0.27-0.48*	0.24	
10	0.62	0.40	
12	0.51-0.79	0.36-1.13	0.88
15	1.32	0.68	1.00
18		0.84	1.20
24	2.00-3.48	1.30-2.90	1.80
30			2.56
36	4.80-8.60		3.48
42			(10.10)†
60			(21.30)†

*Installed $1.05 for 6-in., and $1.35 for 8-in. †Installed $2.05 for 18-in.

TABLE 3—COST OF SIMPLE HAND EXCAVATION AND SHOVELING, 1946

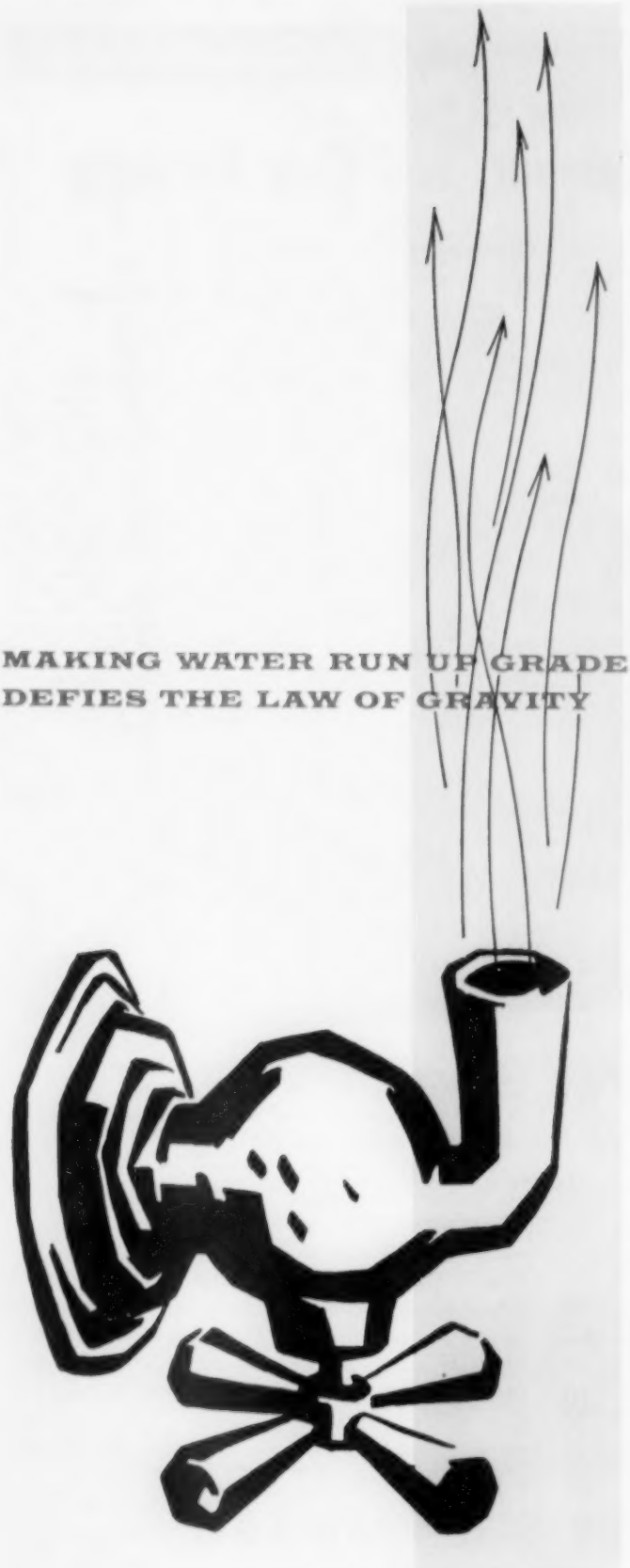
Excavation:	Cu. yd./man hour	$/cu. yd.*
Medium soil, sand or loam	1.0	0.90-1.10
Heavy soil or clay	0.7	1.28-1.57
Hard pan	0.5	1.80-2.20
Shoveling (loose) into trucks:		
Medium soil, sand or loam	0.85	0.76-0.93
Heavy soil or clay	1.0	0.90-1.00
Hard pan	1.25	1.12-1.37

*At 90 cents to $1.10 per hour. The Index for the cost of common labor should be used for other years.

BRICK, TILE AND CEMENT COST INDEXES (1946 = 100)

	Brick: Bldg.	Brick: Fire-clay	Clay products	Concrete ingredients	Brick-layers*	Wages: Common labor	Wages: Refinery labor	Nelson index
1946	100	100	100	100	100	100	100	100
1947	100	114		111	118	115	113	117
1948	123	133	121	119	132	131	128	132.5
1949	128	140	126	122	139	140	137	139.7
1950	132	153	135	125	144	148	144	146.2
1951	141	165	145	133	150	157	152	157.2
1952	141	167	146	133	162	168	163	163.6
1953	143	182	153	138	167	181	174	173.5
1954	145	193	159	142	173	192	183	179.8
1955 est.	149	200	166	148	176	202	190	184.5

*Base rate 1946 = $1.93 per hour. Index based on Bureau of Labor Statistics.



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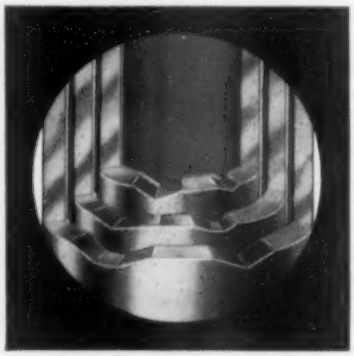

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3¼"	3¾"	4" or larger	1.232	166"
3¾"	4"	5½" or larger	1.640	166"

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by Nicholas Steshko

Sizing Relief-Valve Discharge Headers—3

PART 2 reviewed method of calculation and presented a chart for kinetic energy correction for pressure drop for isothermal flow of gases. A sample solution is given in this concluding part.

Problem:

The sample solution is part of an actual problem which would be too long for this report. So only that line from PSV-1 to the stack will be considered in this solution. The over-all study indicated the following conditions based on cooling-water failure:

Failure: Cooling water.
Valves: Pressure balanced.
Capacity = W = 261,000 lb. per hour.
Molecular weight = 100. R = 1,544/100 = 15.44.
Outlet temperature: 870° R.
Maximum allowable: ΔP = 40 psi.
Equivalent line length: 800 ft.
K = 1.3.
Estimated line size: 12-in. i.d.

Conison solution . . . The outlet condition of the header is assumed to be 14.7 psia. However, a check is made to see if critical flow exists in the header by use of the Crocker[6] formula:

$$P_t = \frac{\frac{W}{D^2}\left[\frac{RT}{K(K+1)}\right]^{1/2}}{11{,}400} \qquad (5)$$

$$P_t = \frac{\frac{261{,}000}{(12)^2(11{,}400)}\left[\frac{(15.44)(870)}{1.3(1.3+1)}\right]^{1/2}}{} = 0.159\,(4{,}490)^{1/2} = 10.7 \text{ psia.}$$

Since P_t is less than 14.7 psia., it indicates that critical flow does not exist and p_2 in the Conison equation becomes 14.7 × 144 = 2,120 lb. per sq. ft. With p_2 and T_2 established, the following terms are readily calculated:

ρ_2 = 0.158 lb. per cu. ft., v_2 = 6.33 cu. ft. per lb.,

V_2 = 584 ft. per second, f = 0.020

$$p_1 = \left[p_2^2 + \frac{V_2^2 p_2}{g v_2} (fL/d) \right]^{1/2}$$

(Note term 2 $\log_e (V_2/V_1)$ is ignored)

$$p_1 = \left[2{,}120^2 + \frac{564^2\,(2{,}120)}{(32.2)\,(6.33)} \frac{(0.2)\,(800)\,12}{12} \right]^{1/2}$$

$$p_1 = [4.49 \times 16^6 + (3.55 \times 10^6)\,(16)]^{1/2}$$

$$= 10^3\,(61.3)^{1/2} = 7{,}380 \text{ lb. per sq. ft. absolute}$$

$$P_1 = 54.5 \text{ psia.}$$

$$P = 39.7 \text{ psi. and } \Delta P = 39.7 \text{ psi.}$$

Lobo, Friend, and Skaperdas solution . . . Since maximum allowable pressure drop in the system is 40 psi., assume:

$$P_1 = 40 \text{ psi.} + 14.7 = 54.7 \text{ psia.}$$

$$\rho_1 = \frac{MW\,(P_1)}{10.72\,(T_1)} = \frac{(100)\,(54.7)}{(10.72)\,(870)} = 0.587$$

The pressure drop in 12-in. line from Fanning equation or from any standard line-sizing charts is approximately ΔP_1 = 20 psi.

$$\frac{\Delta P_1}{P_1} = \frac{20}{54.7} = 0.365$$

$$5.594 \times 10^{-7} \frac{W^2}{D_i^4\,P_1\,\rho_1} = \frac{5.594 \times 10^{-7}\,(261{,}000)^2}{(12)^4\,(54.7)\,(0.587)} = 0.0571$$

From Fig. 4 = the correction factor C_K = 1.615.

$$\Delta P = \Delta P_1 C_K = 20 \times 1.615 = 32.3 \text{ psi.}$$

At first glance, it appears that the results, by the Conison method (ΔP = 39.7 psi.) and the result by the Lobo et al. method (ΔP = 32.3 psi.) are not as close as the author has indicated they would be. However, it should be understood that in the Lobo solution the inlet pressure was assumed to be 40 psi. Since the calculated ΔP was only 32.3 psi., it indicated that the assumption was incorrect and that the inlet pressure was somewhere between 40 and 32.3 psi. Another trial would show the correct inlet pressure to be close to 37 psi.

The results are now close enough for normal ΔP calculations. The difference here could be slide rule and chart interpretations.

Acknowledgment . . . The writer wishes to thank the management of the Fluor Corp., Ltd., for the opportunity granted to publish this paper, and to J. Conison and W. Carmack for their invaluable assistance in the preparation of this paper.

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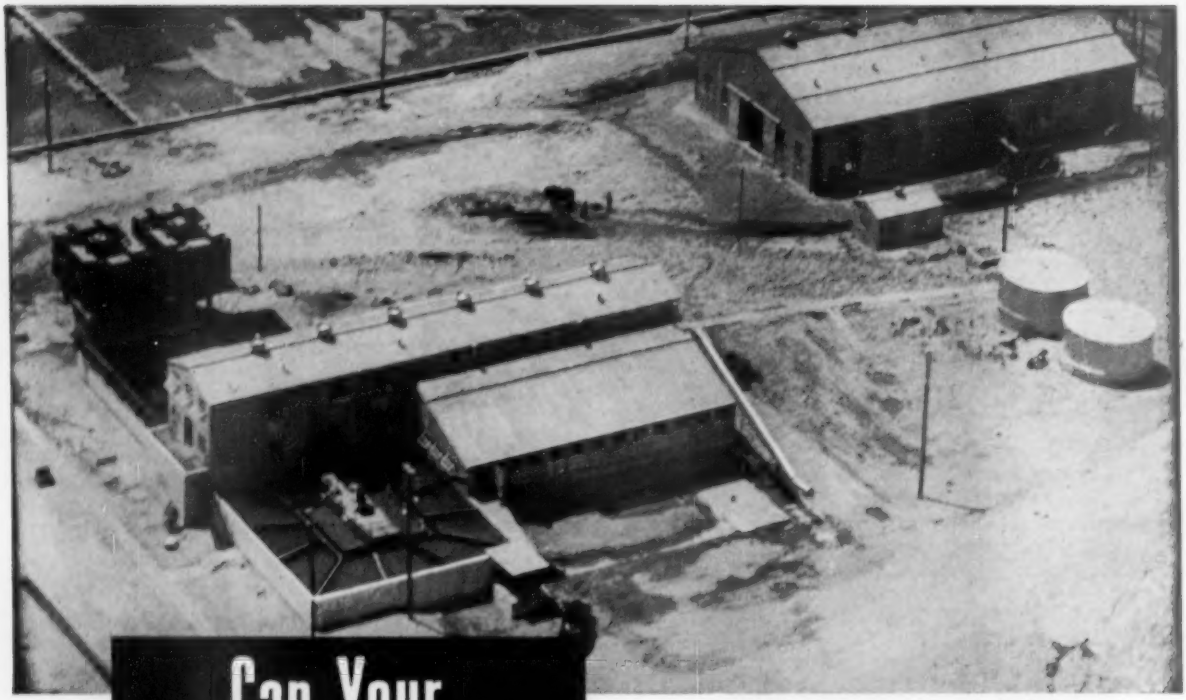

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Pointers on Measuring Wet-Gas Streams—3

THE effect of hydrates, fluid in meter, and pulsation was considered in previous installments. Here, in the concluding installment, the authors take up the effect of liquid in meter run and determination of wet-gas gravity.

4. Liquid in Meter Run

The conditions which can cause pulsation also can cause the more serious error of fluid building up in the upstream section of the meter run.

In wells where the ideal conditions of pressure and temperature discussed earlier do not exist (and liquid is present in the liquid state in the well effluent), some liquid will drop out and dam up in the upstream section of the meter run. This condition results in the gaseous part of the well effluent passing through what amounts to a reduced i.d. meter run.

This effect will produce a low-differential reading because the Beta ratio existing (in the meter run partially filled with fluid) is higher than the ratio used in calculating the coefficient. A meter run sized to produce a high Beta ratio and high differential will minimize this error except in cases of extreme fluid buildup.

Eccentric-orifice plate . . . Some experimenting has been done with the eccentric-orifice plate to alleviate this condition. The principle of this plate is to install the orifice flush with the bottom of the meter run, thereby providing a free exit for the liquid to pass through without the damming effect.

Unlike the concentric plate which has been the subject of exhaustive test work (resulting in highly accurate emperical coefficient data), the eccentric has no published empirical coefficients. But a usable, reasonably accurate coefficient can be calculated by using a curve developed by L. K. Spink and the empirical coefficient for the same-size concentric-orifice plate.

The resultant coefficient is higher than the concentric-plate coefficient by 0.5 per cent to 3.5 per cent—depending upon the Beta ratio and Reynolds number involved. The principal objections to the eccentric plate are the difficulty in machining the plate and the extreme care necessary in installing the plate properly.

We should look forward to the further development of eccentric-orifice coefficient calculations so that the use of these plates, where necessary, could be advocated in contracts and gas-gathering agreements.

5. Wet-Gas Gravity

The determination of the gravity of a gas that contains no liquid can easily be accomplished by measuring that gravity with a gas balance.

This method, however, is not possible with wet gas because of liquid condensing in the balance when the sample is introduced. When this occurs, we no longer have a representative gas sample in the balance. And, at the same time, an error may be introduced by liquid depositing on the float and by changing the balance point.

From fractional analysis . . . The most accurate means of obtaining a correct full-well-stream gravity is from a fractional analysis. This is accomplished by calculating the molecular weight of the well effluent and comparing it to that of air. For example:

	Mole fraction	Molecular weight	
C_1H_4	92.42	16.042	14.826
C_2H_6	4.23	30.068	1.272
C_3H_8	1.62	44.094	.714
C_4H_{10}	.38	58.120	.221
C_4H_{10}	.52	58.120	.302
C_5H_{12}	.22	72.146	.158
C_5H_{12}	.14	72.146	.101
$C_6H_{14}+$	.47	86.172	.405
	100.00		17.999

Molecular weight of gas = 17.999

Molecular weight of air = 28.966

= .621 specific gravity

Most gas-gathering contracts, however, require that gravity be obtained periodically—usually monthly or quarterly. If a large number of wells were involved and a fractional analysis were necessary in each case, it would be both expensive and time-consuming to determine the full-well-stream gravity by this method.

Railroad Commission method . . . The most practical method of determining a full-well-stream gravity, and one that is widely used, is from the calculated formula found in the Railroad Commission Back-Pressure Test handbook. The information required is:

1. The gas-liquid ratio of the well.
2. The gravity of the liquid.
3. The gravity of the corresponding residue gas.

Formula:

$$\text{Specific gravity} = \frac{Gg + (4.591\ G_L/Ra)}{1 + (1{,}123/Ra)}$$

where:

Gg = residue gas gravity
G_L = specific gravity of condensate
Ra = gas-liquid ratio, cu. ft./bbl.

Example:

$$\text{Specific gravity} = \frac{0.620 + (4{,}591 \times 0.7467)/116{,}660}{1 + (1{,}123/116{,}660)}$$

$$= 0.649/1.0096 = 0.643$$

The data necessary to calculate this wet-gas gravity can always be obtained from the periodic g.p.m. test data. This testing is required of all wells producing wet gas into a common gathering system for the purpose of allocating liquid production, and not for the sole purpose of wet-gas-gravity determination.

In the higher gravity ranges, it is possible to have several hydrocarbon mixtures that will result in the same calculated wet-gas gravity but have different critical temperatures and pressures. This will naturally affect the Fpv factor.

Authors are with La Gloria Oil & Gas Corp. Paper presented at N.G.A.A.'s Shreveport meeting.

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REFINER'S NOTEBOOK

Filtering Trace Metals From No. 6 Fuel Oil—1

THIS short series (two installments) deals with experimental removal of trace metals from No. 6 fuel oil by filtration. The object is to produce a less-corrosive fuel for use in gas turbines. The process was carried out with a precoat of diatomaceous earth on a model continuous-rotary-vacuum filter.

1. Results have shown that the method can reduce the sodium content of residual fuel oil to a few parts per million from original concentrations in excess of 200 p.p.m.

2. Reductions also have been observed in calcium, iron, aluminum, lead, and magnesium, as well as sediment and total ash.

3. Present data indicates that the process is economically feasible.

Residuals such as No. 6 fuel oil offer attractive reductions in fuel costs. They are often not realized because of such disadvantages as high viscosity, high ash content, and excessive frictional wear and corrosion tendencies.[1] (Editor's note: Bibliography will appear with the second and final installment).

In the field of gas turbines, for example, fuel-cost reductions are offset by losses due to seriously accelerated corrosion of buckets and other high-temperature turbine parts. Studies[2,3] have traced this trouble to metal or metal-ion impurities in the oil such as sodium, vanadium, and calcium (which form a corrosive, sticky ash).

A number of processes planned to remove these metals[4,5,6] or inhibit their corrosive activities[7,8] have been investigated by gas-turbine manufacturers and others.

At the time the present work began, the only available literature on the filtration of No. 6 fuel oil was concerned with the removal of sediment and water by leaf and cartridge[9]. These afforded little or no reduction in the concentration of the corrosive elements. The search for a more satisfactory filter began with a study of refinery practices[10].

Precoat . . . The initial selection of a filter was a precoat cake of fine diatomaceous-earth filter aid. This cake could be discarded if plugged during batch filtration. If data indicated only surface plugging, a continuous rotary filter might be used to provide the ultimate in earth economy.

A further advantage was that a precoat filter readily lends itself to: (1) processes involving chemical pretreatment of the oil; or (2) the use of adsorbents which may increase the effectiveness of filtration in removing trace metals.

It was recognized that filterable solid compounds in the oil might be dissolved by sea water during marine shipment, and that the sea water itself was a further source of contamination.

Experimental Investigations

Materials were first evaluated in batch-filtration tests. Further experiments suggested that the problem of plugging might be met by use of a continuous rotary precoat filter in which a doctor knife constantly removes surface layers of the precoat filter cake[11] as they become plugged.

Filtration . . . To evaluate the process using such a unit a (12-in. diameter by 2-in. drumwidth) laboratory model continuous-rotary-vacuum filter was obtained. And it was assembled, together with accessory equipment, as indicated in Fig. 1.

Precoats were deposited by vacuum filtration of a 2 per cent slurry of earth in oil.

Temperatures during precoating with these vehicles were 120° F., room temperature, and 200° F., respectively. When a cake about 1½-in. thick had been deposited on the rotary filter drum, the slurry was drained from the filter tank and lines, and No. 6 fuel oil at 200° F. was fed to the filter. Temperature was maintained by recycling feed to the heated supply drum.

After cake-cutting was begun, 30 minutes were allowed at each setting of drum speed and cut to permit operation to stabilize before measurements were made of filtered-oil flow rates.

Metal determinations . . . Sodium determinations by flame photometry (and in some cases, complete spectrographic trace metal determinations) were made on raw and filtered oil samples. Calcium was determined by Versene titration. The following additional data were recorded during each run:

1. Precoat thickness.
2. Precoat width.
3. Viscosity of raw oil.
4. Vacuum at filter.
5. Feed-oil temperature.
6. Minutes per drum revolution.
7. Depth of knife cut per revolution.
8. Quantity of filtered oil passed.

Over 50 tests were performed during about 40 hours of cumulative operating time. Results will be discussed with next and final installment.

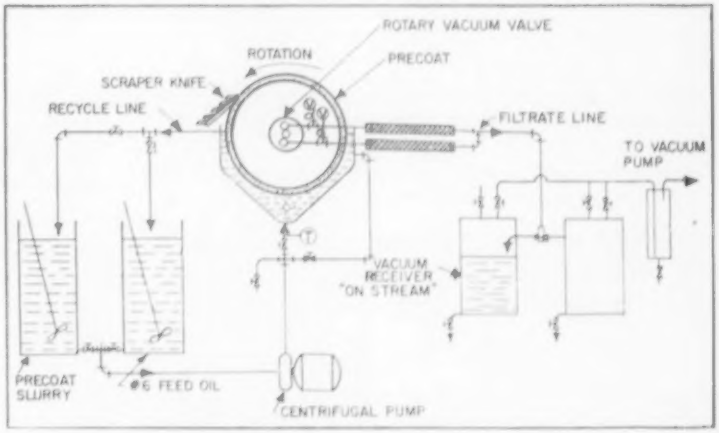

FIG. 1—Laboratory model of filtering system used.

Author is chemical engineer with General Electric Co., Schenectady, N. Y. From paper presented at A.S.M.E. Chicago meeting.

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Pointers on basic corrosion control

Here are bits of helpful information for the beginning corrosion engineer taken from a recent short course on corrosion control sponsored by the Tulsa section of N.A.C.E.

by Robert G. Deering
Associate Pipeline Editor

WHAT'S a surface potential survey?" "Why do you insulate pipelines from road casings?" "How do you plot corrosion survey data?" Such were the questions asked in Tulsa recently at the corrosion short course sponsored by the Tulsa section of National Association of Corrosion Engineers.

Questions came from foremen, technicians, and engineers—most of them novices in corrosion control. Answers were given by experienced corrosion engineers through lectures, field demonstrations, and panel discussions. About 225 men attended the meeting, highest number in the short course's history. The following pointers are a condensation of some of the discussions.

Inspection During Coating

Good coatings start with clean pipe. See that cleaning-machine knives and brushes are tight enough to remove all dirt, loose rust, and scale from the pipe.

A good check on new pipe for thoroughness of cleaning is to stop the machine and scrape the pipe with a dull knife blade. No more than a thin film of rust should form on the blade. If more forms, either the knives and brushes on the machine are worn out, not tight enough, or the machine should be run in a lower gear.

Running in low gear and with two or three rows of knives may be the only answer to cleaning old or second-hand pipe having many pits and heavy rust.

Primer should be put on evenly; watch for a barber-pole effect behind the primer rugs. This means that one primer rug is tighter than the other—so ask the operator to even them up.

When priming pitted pipe, touchup brushes attached behind the primer rugs are a must. These brushes wipe primer into dry pits and flip excess primer out of others. Their use eliminates any need for following the machine to touchup holidays.

As for the amount of primer you can expect to use in a given distance, don't depend too much on manufacturers' listed quantities. The actual amount to be used will depend on pipe surface, amount of waste, number of stops, etc. Just see that the pipe is primed evenly—not heavy enough to drip and not thin enough so pipe will show.

A good prime coat for straight-run enamel will dry glossy black in 20 to 45 minutes, depending on temperature.

Between cleaning and coating operations, check all welds to see that no primer holidays exist there. If the pipe has been primed for several days, check for dead primer. (Except in extremes of weather, primer will stay alive for weeks). Live primer should slice off the pipe in a thin ribbon when tested with a knife blade. Even in cold weather (when it might flake off), it should still roll up in a soft ball between the fingers. Remember, a good coating bond depends on good primer.

When watching the coating operations, don't neglect the blind side of the ditch. The working side will usually be too busy for you to see all phases of the work. Learn the proper temperature for the coating being used and check periodically with the pot foreman to see that temperature is kept. Don't allow cold coating to be added to the pot while coating is going on. Temperature can't be kept constant if this is done.

With coal tar enamel, it's easy to tell when temperature is too high—yellow smoke will boil from the kettle and from the machine.

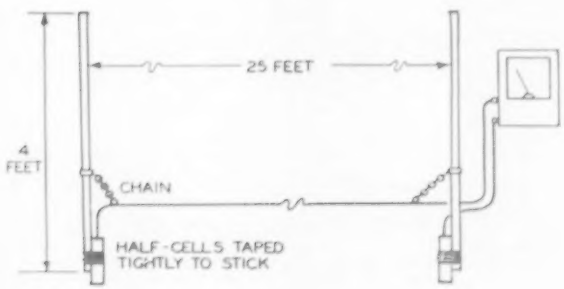
Trouble at stops . . . Usually when a coating machine gets strung out over a long run, it gives little trouble. Jeeping may show up a holiday every joint or two, particularly on weld buttons. But long stops may cause trouble. The coating may get too cool in the machine, the shoe may drag if the machine has been lowered to the ground, the nozzles in the shoe may clog, and many other things may occur. So the inspector should pay close attention to the machine operation just as it starts up from a long stop.

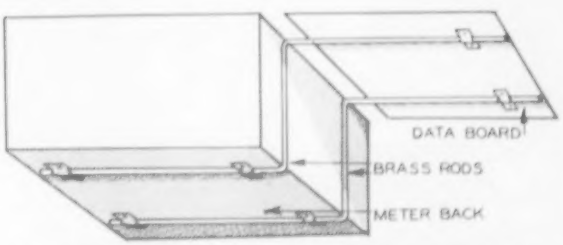
Don't waste dope; your company is paying for it! A big source of trouble here is in letting the coating-machine operator keep the machine's catchpan too full on hills.

Finally, watch the patch men to make sure that they don't tear up more coating than is repaired at holidays. A holiday is usually a small imperfection in the coating which needs only a daub of coating and a wrap of felt after being scarfed out with a curved bladed knife. Beating a lot of coating off around the holiday only damages surrounding material.

Corrosion Measuring Techniques

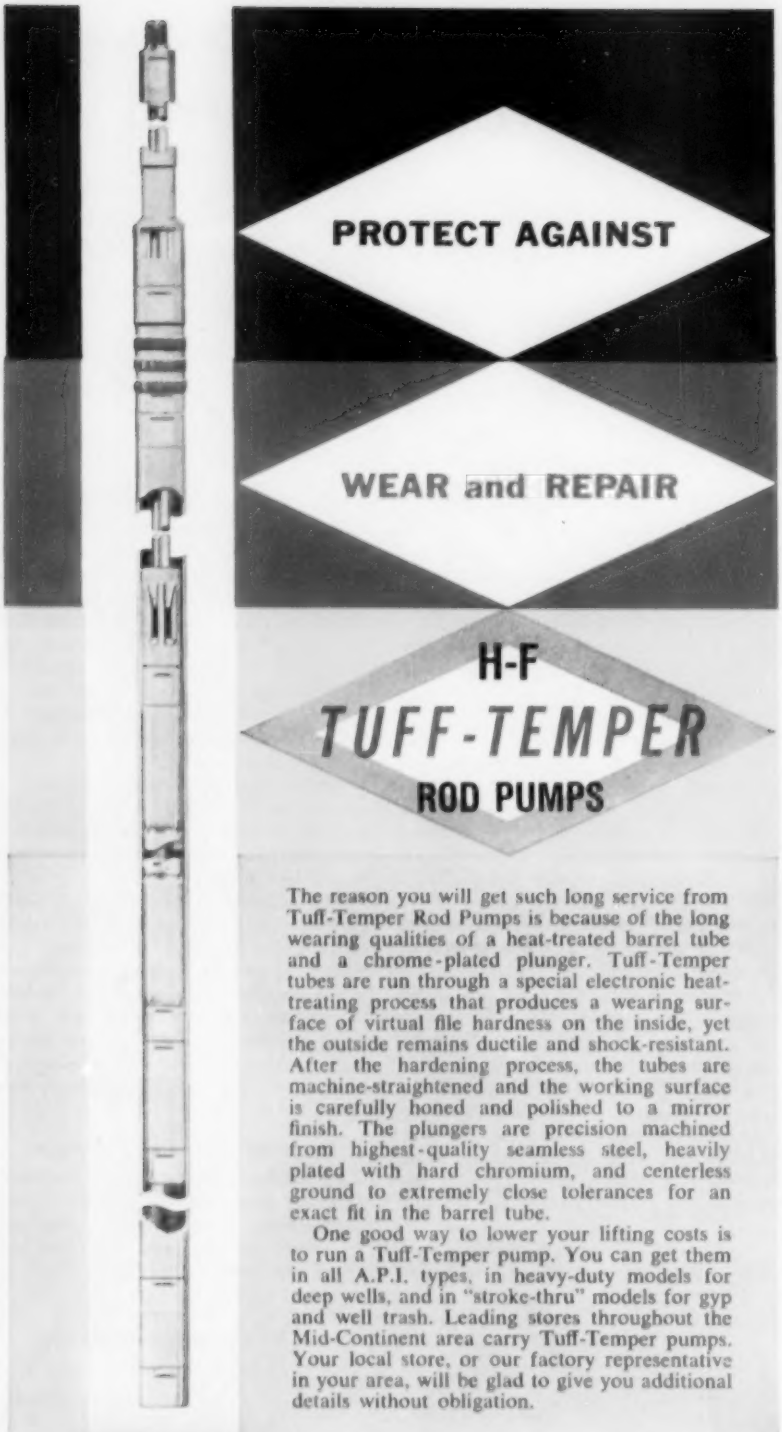
Per dollar and hour spent, surface-potential measurements will give more information about possible corrosion on a bare line than any other method. These are merely the voltage readings





LEFT: For faster surface-potential surveys, tape copper-sulfate electrodes to 4-ft. sticks, cut meter leads to the distance desired between stations. Fig. 1.

ABOVE: For faster data recording, make form from brazing rod and attach data book to meter. Fig. 2.



The reason you will get such long service from Tuff-Temper Rod Pumps is because of the long wearing qualities of a heat-treated barrel tube and a chrome-plated plunger. Tuff-Temper tubes are run through a special electronic heat-treating process that produces a wearing surface of virtual file hardness on the inside, yet the outside remains ductile and shock-resistant. After the hardening process, the tubes are machine-straightened and the working surface is carefully honed and polished to a mirror finish. The plungers are precision machined from highest-quality seamless steel, heavily plated with hard chromium, and centerless ground to extremely close tolerances for an exact fit in the barrel tube.

One good way to lower your lifting costs is to run a Tuff-Temper pump. You can get them in all A.P.I. types, in heavy-duty models for deep wells, and in "stroke-thru" models for gyp and well trash. Leading stores throughout the Mid-Continent area carry Tuff-Temper pumps. Your local store, or our factory representative in your area, will be glad to give you additional details without obligation.

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taken between two copper sulfate electrodes placed on the ground directly above the pipeline and about 25 to 100 ft. apart. A plot of results of a series of such readings gives the potential of the line and clearly shows anodic and cathodic regions.

Before starting the survey, balance the two copper sulfate electrodes (or half cells) to be used. They should be filled with distilled water from the same source and filled with copper sulfate crystals from the same box. To check their voltages, place them on the ground close together and measure the voltage between them. It should be within a few millivolts. If not, you may have to clean and refill them.

To aid in keeping polarity of each reading straight, consider the rear or back electrode as the reference. Then the potential of the station at the lead electrode is either higher or lower by the amount of the reading (which may be either positive or negative).

At the start of the survey, of course, an actual pipe-to-soil potential reading should be made so as to have a base value to refer all readings. A check pipe-to-soil reading should be made after about 10 to 20 surface readings. Adding all the surface readings to the first pipe-to-soil reading and taking care to observe the sign should give the second pipe-to-soil reading. If not, look for one reading that is about half the difference between the two pipe-to-soil readings. You may have recorded a reading as plus when it was actually negative. When the data are plotted, the anodic regions will show up as having higher natural potentials than the cathodes.

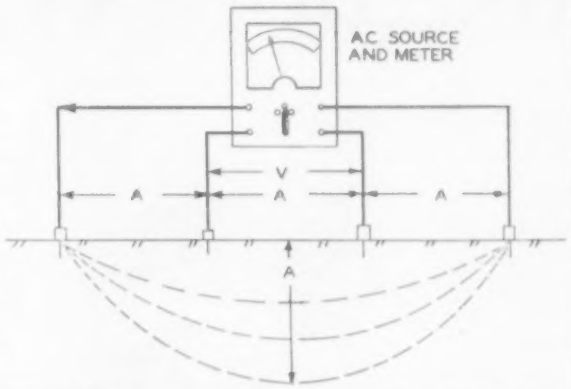
Speed in making a surface-potential survey depends on little things. First, the line should be staked out beforehand by a separate crew of two men. Then the actual survey crew should have three men—one to handle the instrument and data book, the other two to handle the electrodes.

Simple broomsticks can increase speed. Tape the half cells tightly to a 4-ft. stick so you don't have to bend over to make settings. Also, the lead wire between half cells should be just a few inches over the distance which you want to have between measuring points. And it should be given some slack by having a small chain attached to the lead wire to keep from pulling it out of the half cell. See Fig. 1.

Another simple way to speed field work is to secure the data book or sheets to the meter. Remove the meter feet and shape brass welding rods so the book will be even with the meter top. Use spring clips to hold the book to the rods (Fig. 2).

PIPELINE PATROL

Soil - resistivity measurements . . . A good rule of thumb to follow in testing soil for corrosiveness is as follows: (1) soils with resistivities below 1,000 ohm-cm. are usually corrosive; (2) soils above 10,000 ohm-cm. are rarely very corrosive; and (3) soils between 1,000 and 10,000 ohm-cm. are relatively corrosive. Also corrosiveness depends on differences in resistivity of adjoining soil strata which the line goes through.



IN THE FOUR-POINT METHOD of measuring soil resistivity, keep distance between pins at multiples of 5.23 ft.—it gives a simpler multiplying factor. Fig. 3.

In making a soil-resistivity survey, use either the single rod or the four-point method. Readings about 300 ft. apart are good to start with. Then, split the distance, (i.e., take readings at shorter intervals where soil conditions show an obvious change) where an unusually high or low reading appears or if you need to outline or pinpoint areas of high or low resistance.

In making readings with a resistivity rod, don't worry if you have to use water to get down to pipe depth. Chances are the average measured resistivity will be changed only a small amount.

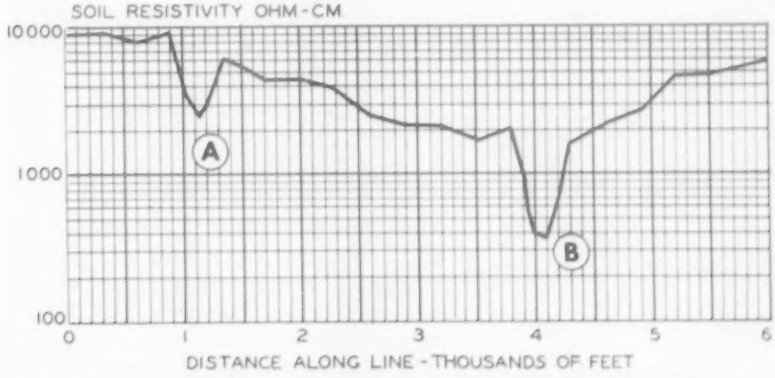
The formula for resistivity using the four-point method (shown in Fig. 3) is p, (in ohm-cm.) = 191a (V/I). This is where a is in feet and V/I is the meter reading. So if pin spacing is kept at multiples or submultiples of 5.23 ft., the multiplier will be an even number like 1,000, 1,500, 2,000, etc. This will prevent tedious calculations and lead to fewer mathematical errors.

Screwdrivers, either 4 or 6-in., make excellent electrodes for the four-point method. No polarization problem exists if an a.c. instrument is used and the screwdrivers are easy to drive into the ground.

Don't be concerned if resistivity measurements have to be made close to a pipeline. The error in average resistivity caused by the small volume of pipe in the field of the measurement will be small.

In plotting soil-resistivity data, use semilog paper. This will give equal weight to the ratio of differences in resistivity of soils in different ranges. If rectangular coordinates are used, readings through the most corrosive soils will be compressed in the lower end of the scale and will not appear as serious as differences in readings through high-resistivity soil.

For example, in the curve of Fig. 4, Point B will probably cause a more vicious corrosive cell than Point A. But if plotted on rectangular coordinates, it would appear far less significant.



PLOT soil resistivity data on semilog paper so that anomalies in low-resistivity soil won't be compressed into insignificance in the lower part of scale. Fig. 4.

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Drilling Contractors

Dixie Drilling Co., Dallas, has the contract for the projected 16,000-ft. exploratory test Union Oil Co. of California is starting on the southeast flank of Lake Hatch field, about 9 miles southwest of Houma, in Terrebonne Parish, Coastal Louisiana. Location is listed as 1 LL & E Co. Unit 1. Dixie also has a new 9,500-ft. contract operation in the Napoleonville area, Assumption Parish. The latter is for Delhi-Taylor Corp. at 1 Armelise, in 26-12s-14e. Location is about ¾ mile southeast of production.

Salt Dome Production Co., Houston, will drill an 8,000-ft. wildcat test in Jefferson Parish, Coastal Louisiana, on a contract for Sam J. Recile, of New Orleans. Its location at 2 Dwight Jones, in 2-17s-24e, is about 2 miles northeast of production at Lafitte.

Dillard & Waltermire Drilling Co., Houston, is keeping a rig going for Gulf Oil Corp. in deep development in the Addison Ranch area of northwestern Lea County, New Mexico. Latest operation is Gulf's 4 Lea-State, in 2-16-32, on the north side of the area. It will be a 13,500-ft. test.

Continental Drilling Co., Ltd., is on a rank wildcat location 20 miles northwest of Pecos, in northern Reeves County, in far-western Texas' portion of the Delaware basin, where it is drilling on contract for Marine Gathering Co., Midland, Tex. The test, 1 TXL, in Section 3, Block 54, T-4, T&P Survey, is scheduled to go to 8,000 ft.

Gulf Drilling Co. has contracts with Sutton Joint Account, of Lake Charles, La., for two relatively shallow wells on the southeast flank of the old West Hackberry field, in Cameron Parish, Coastal Louisiana. The first is 1 Ellender, and the other 1 Duhon. Both are in 28-12n-10w, and will go to 3,700 ft.

Yates Drilling Co. is contractor on a new 11,000-ft. operation in the Iota area of Acadia Parish, southern Louisiana, where it is drilling for Elge Rasberry, of Iota, La. Permit calls for 1 John Dietz et al, in 19-8s-11w. It now is completing 5-B Lejeune, another 11,000-ft. well in the same area, and also has contracted for 2 Dietz.

Noble Drilling Co., Tulsa, has the contract for another well California Co. is starting in the new Bayou Villars field, St. Charles Parish, Coastal Louisiana. It is an 8,800-ft. operation at 6 State Lease 2704, in Township 15s-23e.

Trend Drilling Co. is on a new wildcat job 13 miles west of Encino, in

Frank Hammerson (lower left), drilling foreman; Lionel Hammerson (lower right), mud engineer; and drilling crew on General Petroleum Corp.'s rig which set a new fast-drilling record in California (The Oil and Gas Journal, February 27, 1956, page 83). This crew, drilling on General's 244 Santa Fe, in Santa Fe Springs field, Los Angeles basin, made 2,305 ft. of 12¼-in. hole in one 8-hour shift.

Crewmen are: Top row (left to right), R. L. Gautereaux, D. E. Lowell, J. V. Brookshier, and R. T. Bielefield, rotary helpers; and, bottom row (center three), L. T. Carter, derrickman; P. P. Hodges, driller; and Ellery Sales, rotary helper.

The crew took over the hole at 376 ft. and went off tour with depth at 2,681 ft. Hole was cut with one bit, and no roundtrips were required. The crew made 74 connections, averaging one every 6½ minutes.

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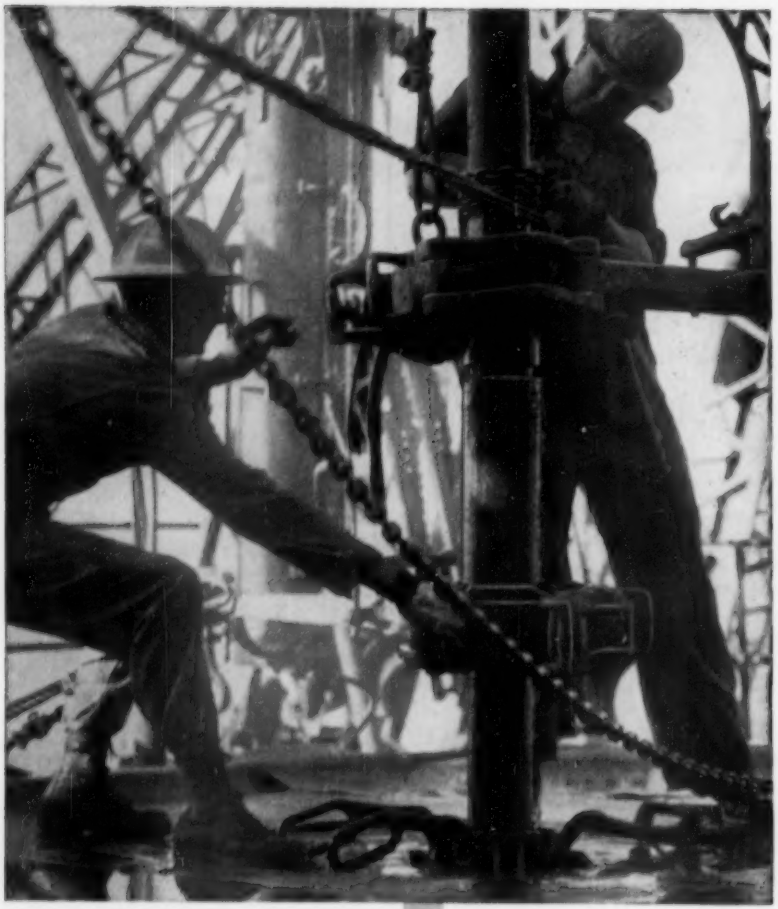

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western Brooks County, Southwest Texas. It is a 6,500-ft. test for Hawn Brothers at 4-B Mestena, in Share 11, La Mestena Y Gonzalena Grant. Location is southeast of North Alta Mesa field, and northwest of Scott-Harper field.

Survey Drilling Co., Dallas, has scheduled an 8,500-ft. test to be drilled for A. R. Temple, of Biloxi, Miss., at a rank wildcat location 4 miles southeast of Foley, in Baldwin County, southwestern Alabama. It will be Temple's 1 Walsh and Ehle, in 15-8s-4e. Location is 60 miles from the new Citronelle Rodessa field in northern Mobile County.

Mississippi River Fuel Corp. has taken a drilling contract for a 12,700-ft. semiwildcat test Natural Gas & Oil Co. and Tide Water Associated Oil Co. have projected for the East Golden Meadow area in Lafourche Parish, southeastern Louisiana. It is designated as 1 Hoy et al, with location in 31-19s-23e.

Cable Tool & Rotary Drilling Co., Overton, Tex., has a rotary rig working for Phillips Petroleum Co. at a wildcat location 2 miles northeast of Alto, in Cherokee County, East Texas. It is a 5,400-ft. contract at 1-A Cannon, in Tillman Walters Survey.

Nye & Snell Drilling Co., Hayes, Kans., is doing the drilling on a joint operation with Baumgartner Oil Co. at a wildcat location 3 miles southwest of Big Beaver field, in Adams County, northeastern Colorado County. Listing of the test is 1 Jolly Ranch, in 25-3s-57w.

Gene Reid Drilling, Inc., Bakersfield, Calif., has a new wildcat test working northwest of Taylor Canyon field in San Luis Obispo County, California. It is a Trico Oil & Gas Co. contract. Listing is 21-25 Socalpet, in 25-32s-19e. Location is 1¼ miles from Morales Canyon field. Contract is for 5,500 ft.

Casey & Montgomery, Bakersfield, Calif., will drill another well for Oceanic Oil Co. in the Willmax area, near Fellows and 2½ miles west of Taft, in Kern County, California. Latest operation is at CWOD 82X, in 17-32-23, about a mile northwest of production.

T. C. Strain Drilling Co., Denver, is scheduled for a wildcat test to be drilled for Bryan W. Payne, Shawnee Oil Co., and its own account at 1 Dressel in 33-8n-52w, a mile east of Sterling, in Logan County, northeastern Colorado.

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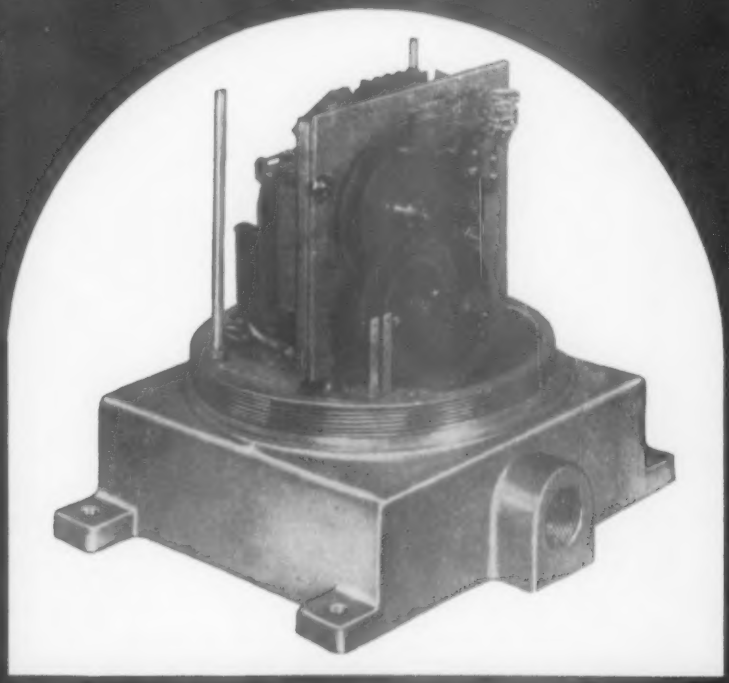

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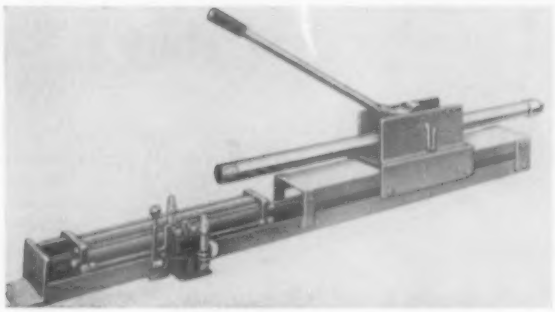
OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller



Pusher Drives Pipe Under Roads

A new portable hydraulic pipe pusher for use in the oil field requires no manual labor. The fully power-controlled pushing operation utilizes the Speed-Thru hydraulic pipe pusher. The Speed-Thru pusher, which is operated by only one man, will simplify and economize gathering-line or refinery pipeline operations which require pipe beneath highways, railroads, or similar obstructions.

Three models available handle ¾ to 6-in. pipe. Performance records of 75 ft. in 18 to 20 minutes on 2 to 4-in. pipe through formations like hard shale or hard-pack roadbed, and distance pushes of 120 to 186 ft. in comparable time indicate the speed and economy of this method.

Operation of two controls pushes pipe in continuous 21-in. thrusts. Two 25-ft. hydraulic pressure and return hoses, equipped with quick couplers, expedites setting. Dust caps and plugs protect couplings when not in use.

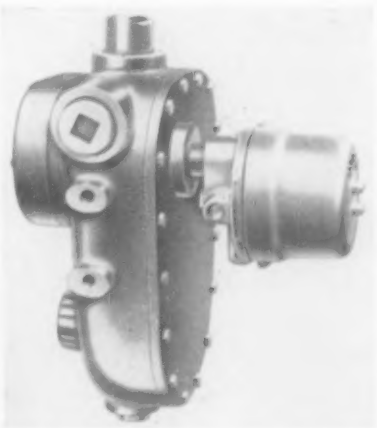
By reversing the forward pushing principle, Speed-Thru will pull pipe as rapidly as it pushes, without turning the machine or adjusting power or speed. **For more information write or call: Mercury Hydraulics, Inc., 2440 Blake Street, Denver 5, Colo.**

●

Pneumatic Level Control For Tank-Switching Systems

Standard units of a new pneumatic level control are available in two models. One model trips at high level and one trips at both high and low levels. Both of these units mount on the latest type of Varec automatic tank gage, which is powered by a Neg'ator motor. Either model may be mounted on other types of tape-reading and high-pressure gages by using adapter kit.

The unit is triggered by a cam, which can be adjusted to operate at either high or low levels at any float position within a range of 24 ft., the equivalent of 270° cam rotation. Adjustment is made by Vernier screw, which locks on correct setting with a lock screw.



The pneumatic level control may be used to actuate pumps, motor-operated valves, or other operating equipment and is designed to be converted to a remote control system by pulse code telemetering. **For more information write or call: Vapor Recovery Systems Co., 2820 North Alameda Street, Compton, Calif.**

●

Control Valves Designed For Unlimited Pressures

Two new control valves, the diaphragm-actuated Type CV-D and the piston-actuated Type CV-P, are designed to handle all fluids at unlimited pressures. The CV-D valve has a wider range of application than older styled Copes diaphragm-actuated valves. The CV-D valve may be direct or reverse in action.

Simple in design and easy to maintain, the CV-P valve also has extreme rangeability. It has ideal operating characteristics and its piston actuation develops high force to deal with static and dynamic unbalances and with stuffing-box friction.

Both valves will handle water, steam, air, gas, oil or other similar fluids at unlimited pressures. Each valve opening provides the correct flow at all times. The valve bodies are made of cast iron or cast steel in either straight-way or angle style. Designed for individual installations, the fittings are stainless steel, single or double seat, with hardfacing when required. **For more information write or call: Copes-Vulcan Division, Blaw-Knox Co., Erie, Pa.**

●

Explosionproof Expansion Union Made for Conduit

A one-piece, sliding-sleeve expansion union that compensates for conduit which has been cut too short also eliminates the need for springing conduit to one side while installation of the union is made.

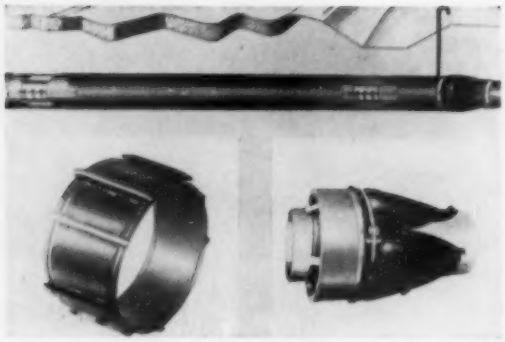
These condulets, made in standard and extra-long lengths are smaller in diameter than conventional unions and are available in ½, ¾, and 1-in. sizes. They are readily used in installations

OIL AND GAS JOURNAL *Showcase* ..... OF NEW EQUIPMENT

where unions of larger diameter would make connection difficult.

The union is factory assembled as a one-piece union, eliminating the possibility of lost parts. It consists of two cylinders, one fitting inside the other. The longer union expands to compensate for errors in cutting conduit too short, and can thus be used as an expansion fitting.

Surfaces mate accurately, insuring a long enough contact to prevent passage of flames at full expansion. These condulets thus meet specifications for use in hazardous locations where explosion-proof and dust-tight features are required. In addition, locking and grounding springs guarantee positive grounding continuity at all times. **For more information write or call: Crouse-Hinds Co., Wolf and Seventh North Streets, Syracuse, N. Y.**



Crossing Insulator Has Neoprene Seals

A new concept in the design of crossing insulators for pipelines passing under highways offers Neoprene end seals that go on in minutes and will seal against pressures ranging up to 300 lb. The seal closure, a pressure-sealing rubber zipper with molded lips, effectively shuts out liquids and dirt. And additional pressure actually tightens the seal.

Because the end seals are made of Neoprene, long life in contact with moisture and soil chemicals is assured. Stainless-steel bands clamping the seal to the casing end and pipe complete the closure.

In place of the customary hard rubber or phenolic runners, the pipe-supporting bands have sled-type steel runners tightly bonded to resilient pads of Neoprene. Slightly angled ends on the runners make for easier entry into a conductor casing and virtually eliminate the possibility of hangup when pipe is being run. The Neoprene backing not only acts as a shock absorber to prevent damage from sudden heavy loads but also provide flexibility to compensate for pipe shifting.

The steel band is ribbed ½ in. from each edge to prevent cold flow of the pipe wrap. The band and runners are so designed and constructed as to eliminate the need for lining the band with rubber. **For more information write or call: Ed Upton, F. H. Maloney Co., P. O. Box 1777, Houston 1, Tex.**

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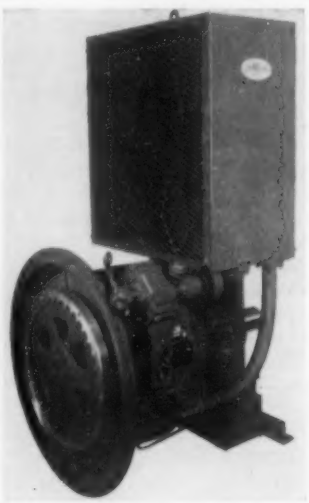


Torque Converter Designed For Oil-Field Engines

The new three-stage 13,800 Series torque converter is added to a line that provides for every horsepower range from 40 to 1,000 and offers four distinct sizes, with a total of 29 capacities, through internal blading variations.

The new converter was designed specifically to accommodate a large number of engines for which previous models were not ideally suited, particularly in the oil fields. It is applicable to: Allis-Chalmers PC1879, DC1879, DSC-1879, PCS-1879, PC-2505; Caterpillar D-342, D8, D-364, D9, D-375, D-386; Climax R-81, V-285, V-330, V-85;

(Continued on page 179)

OIL AND GAS JOURNAL *Showcase Coupon*

USE THIS FORM TO OBTAIN INFORMATION ON ITEM DESCRIBED HERE

MANUFACTURER _____

ADDRESS _____

CITY _____ **STATE** _____

Please send me complete information on the following item

_____

_____

Described in the March 26, 1956 issue of The Oil and Gas Journal

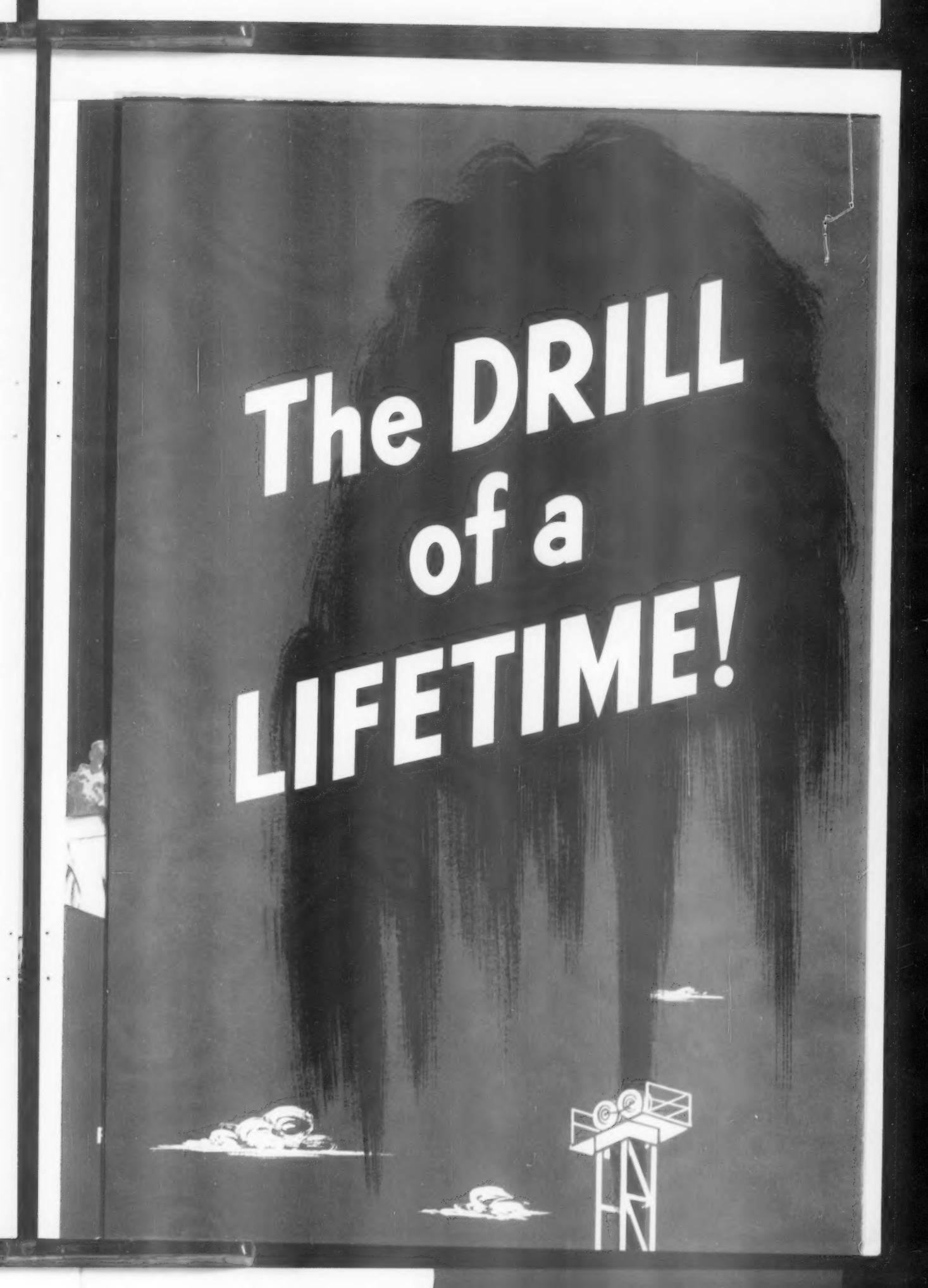
NAME _____ **TITLE** _____

COMPANY _____

ADDRESS _____

CITY _____ **STATE** _____

DATE _____


The DRILL
of a
LIFETIME!

NOW for deep
for shall
Failing
STRATMA

A portable slim h
"The Drill of a Life

Here's a Failing Stratmaster . . . the drill of a lifetime!

The Failing Stratmaster was designed to effect maximum savings, maximum efficiency in slim hole exploration drilling and shallow production drilling. Drilling costs are held to the lowest possible dollar through usage of the Failing Stratmaster.

Here's the answ
more wells per
mobility, rapid
sacrifice in stren
a trailer-mounte
6,500 feet.

CHECK THESE OUTSTANDING FEATURES:

1. **Maximum portability afforded by over-the-road highway package. Rig is 8 feet wide, 50 feet long and weighs 50,000 pounds.**
2. **Minimum rigging up time because of single trailer mounting.**
3. **Five foot clearance under rotary table without trailer ramps.**
4. **No guy wires on mast or working platform.**
5. **Exceptionally wide range of hoisting and rotating speeds.**

3. **Five foot clearance under rotary**

Here are specifica

MAST: Cantilever type with
of clear inside working space. Hi
6500' of 2-7/8" drill pipe or 5
of 100,000 pounds.

FLOOR-STRUCTURE:
vided. Tubular steel constructi
steel grillage beams.

DRAWWORKS: Structur
lightweight guard. Hoisting dru
7/8" line. Drum shaft, 5-15/
with self-aligning roller bearing
1-1/2" pitch. Drum brakes, 32

eep exploration
allow production

ASTER

hole rig
Lifetime!"

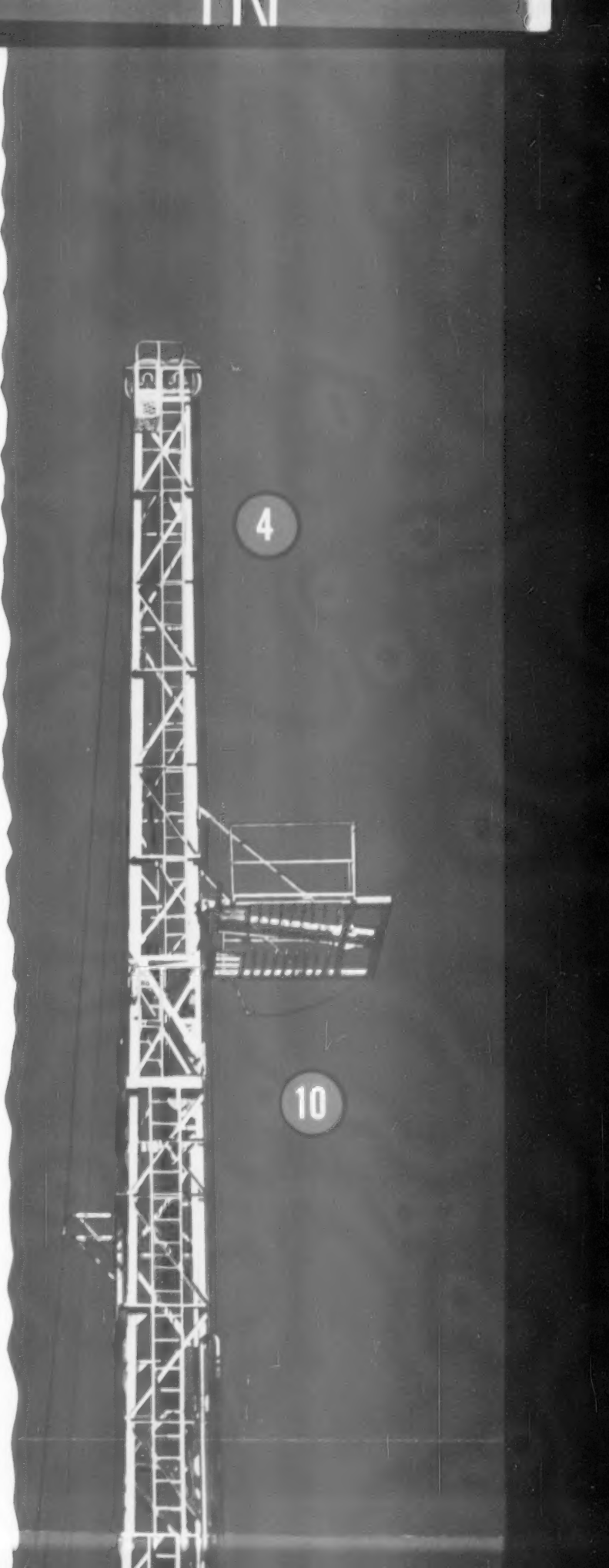
e answer to the oil industry's requirement for *lls per drilling dollar*. Here's a rig designed for rapid rig-up and tear down . . . with no in strength, performance and flexibility. Here's -mounted Failing rig for drilling depths up to eet.

cifications of its major parts:

type with horizontally retracting top section. 83 feet space. Hinged working platform with racking fingers for ipe or 5000' of 3-1/2" drill pipe. Hook load capacity

URE: Ample working and pipe set back area pro- construction, screw type leveling jacks on each leg,

Structural steel frame, completely enclosed with sting drum, 14" spool x 24-3/4" long, grooved for t, 5-15/32" supported by heavy duty pillow blocks r bearings. Drum drive, double or triple roller chain, akes, 32" x 2" flanges, positive quick release, water



ing and rotating speeds.

3. Five foot clearance under rotary table without trailer ramps.
4. No guy wires on mast or working platform.
5. Exceptionally wide range of hoisting and rotating speeds.
6. Torque tube drives to drawworks and rotary table.
7. Rotary table has 16 inch opening.
8. One lever control for clutch and throttles.
9. All controls air operated.
10. Designed for use of Range 2 drill pipe and drill tubing.
11. Trailer and skid mounted slush pump units and drives available as optional equipment. Failing engineering service available for designing rig hydraulic systems.

DRAWWORKS: Structural
lightweight guard. Hoisting drum
7/8" line. Drum shaft, 5-15/32
with self-aligning roller bearings.
1-1/2" pitch. Drum brakes, 32"
cooled. Auxiliary brake 15" dou
running clutch. Drum clutch, Twi
spinning—Foster type "36". Brea
brake flanges, 10" spool x 35"

TRANSMISSION: Allison
and one reverse speeds. Shifts u

ENGINE: Power for the drill
verter equipped single engine, m
joint equipped torque tube dri
works and rotary . . . 180 hors

CONTROLS: All controls fo
console near the rotary table, at
tions and the upper interior of

A Quality Drill for a Minimun

Tear Out This Card and Mail Today for Free Information about the FAILING STRATMASTER

MAIL THIS COUPON FOR MORE INFORMATION

Gentlemen:

Please have a Failing representative call on me. ☐

Please send more information about the drill of a lifetime—the Failing Stratmaster. ☐

Name

Address

City State

Structural steel frame, completely enclosed with
sting drum, 14" spool x 24-3/4" long, grooved for
, 5-15/32" supported by heavy duty pillow blocks
bearings. Drum drive, double or triple roller chain,
akes, 32" x 9" flanges, positive quick release, water
15" double hydromatic with disconnect and over-
clutch, Twin Disc, air actuated, PO 218. Catheads,
36". Breakout-Foster type "35". Sand reel, 27" x 7"
ol x 35" long.

: Allison Model TG 607 Torqmatic. Three forward
s. Shifts under load.

the drilling unit is transmitted from a torque con-
engine, mounted on the drill frame through universal
tube drives. Recommended horsepower for draw-
180 horsepower.

ontrols for operation of the drill are located in a
table, affording the driller a full view of all opera-
terior of the mast.

num Investment!

GEORGE E. Failing COMPANY

A Subsidiary of

WESTINGHOUSE AIR BRAKE COMPANY

ENID, OKLAHOMA, U. S. A.

City State

SLIM HOLE DRILL

Can Save You

Why a Slim Hole Rig?

The objective of the slim hole rig: reduction in the cost per foot of hole drilled. This objective is accomplished by using a drill *designed* for slim hole drilling. Use of a conventional rig to drill slim holes effects no savings. Use of a properly designed slim hole rig can greatly reduce drilling costs.

For the drilling contractor this means a cutting down of overhead and a return to profitable operations with competitive drilling prices.

For the operator this means more footage per dollar invested in drilling costs and a return of economic incentive to drill new wells.

Slim Holes Bring Greater Profits These Ways:

SMALLER CAPITAL INVESTMENT For a given depth hole, a slim hole rig has lower capital investment, less depreciation, lower insurance rates, less taxes and maintenance costs, than a big rig used on a similar job. Further savings in equipment and well completion come from the use of smaller diameter casing, and smaller diameter lightweight drill pipe or tubing.

LOWER MOVING COSTS Slim hole rigs move faster, rig up faster and require less advance site preparation. Where conventional big rigs require from two to four days for rigging up, the slim hole rig is ready for action in a few hours. Designed for portability, the slim hole rig can be moved in far fewer loads.

LOWER OPERATING COSTS The slim hole rig requires less fuel and a smaller volume of mud . . . resulting in lower fuel bills, smaller mud pits, and smaller mud bills. Bit costs, too, are smaller. The newly developed slim hole bits are marvelously efficient. Even when footage drilled per bit is less because of their smaller size, a lower initial cost results in savings still being effected. There's a saving also in manpower because the slim hole rig can operate efficiently with a smaller crew.

LLING

ou Thousands of Dollars

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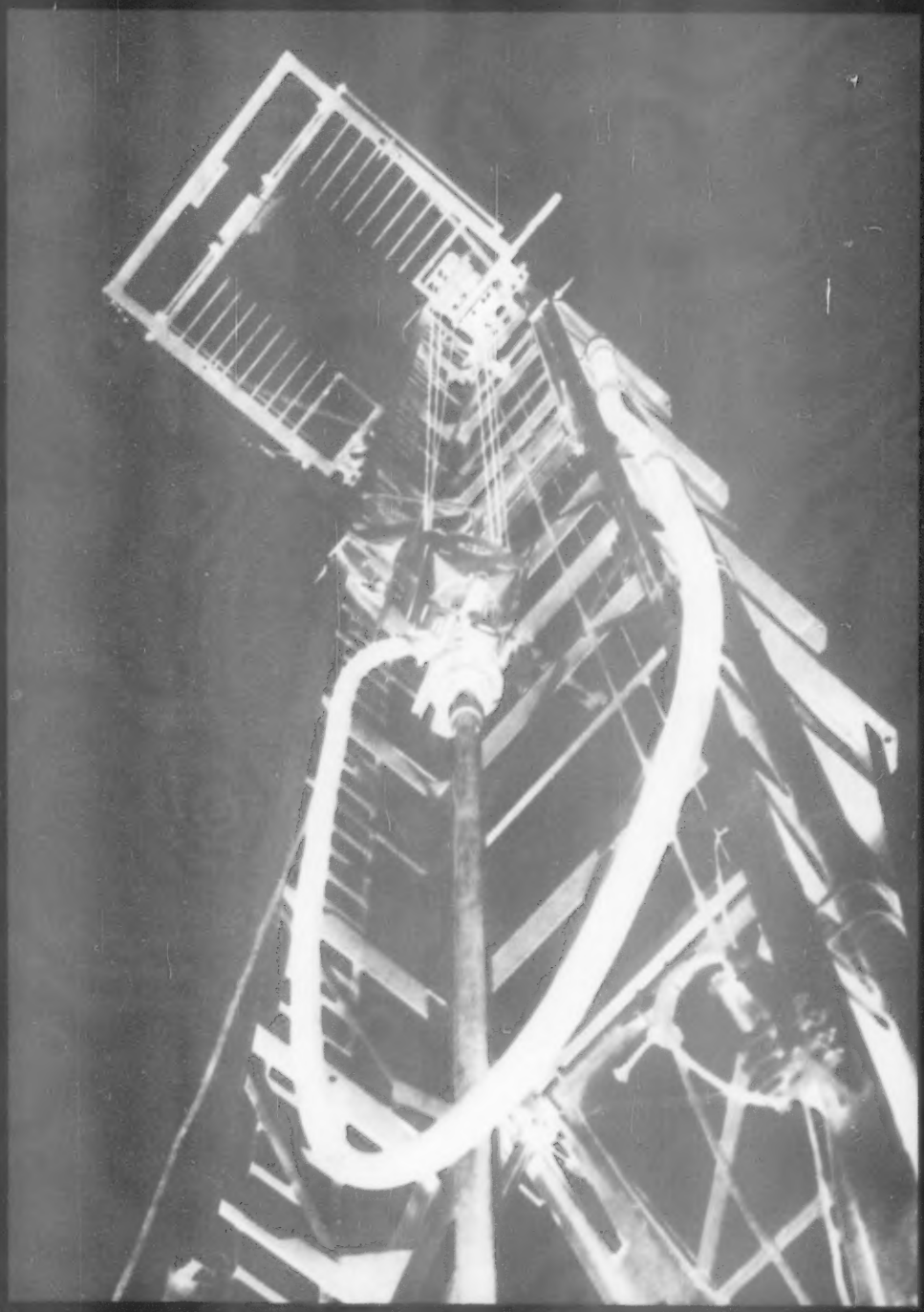


2500 Holemaster

1500 Holemaster

1500-S Holemaster

CFD1 Combination

CFD-2 Holemaster

Failing Backs Every Rig with Full Service, Parts

FAILING'S STRATMASTER is the newest and biggest of the FAILING line of portable drill rigs. The manufacturer of the original portable drilling rig, FAILING still leads the field in the production of high quality engineered portable drilling equipment.

FAILING maintains a staff of experienced field engineers and these men are available to help the users of FAILING rigs.

FAILING service, parts and supplies are available world wide. Ten strategically located stores in the United States and Canada. Qualified agents in all parts of the world.

★ ★ ★

BRANCH SUPPLY STORES

Houston, Texas; Midland, Texas; Casper, Wyoming; Hattiesburg, Mississippi; Grand Junction, Colorado; Grants, New Mexico; Guymon, Oklahoma; Edmonton and Calgary, Alberta, Canada. Export office: 45 Rockefeller Plaza, New York 20, New York.

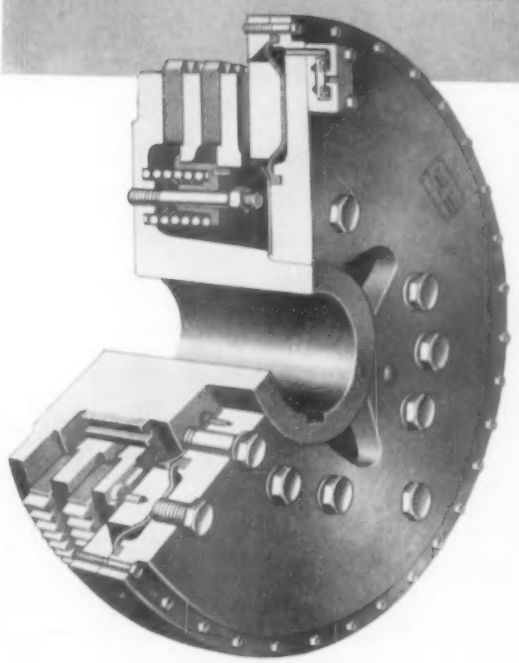
GEORGE E. Failing COMPANY

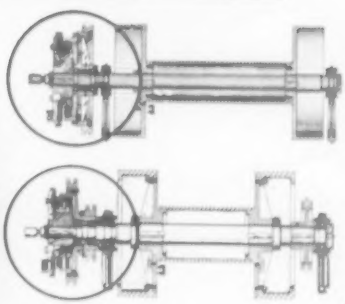
A subsidiary of
WESTINGHOUSE AIR BRAKE COMPANY
Enid, Oklahoma, U. S. A.

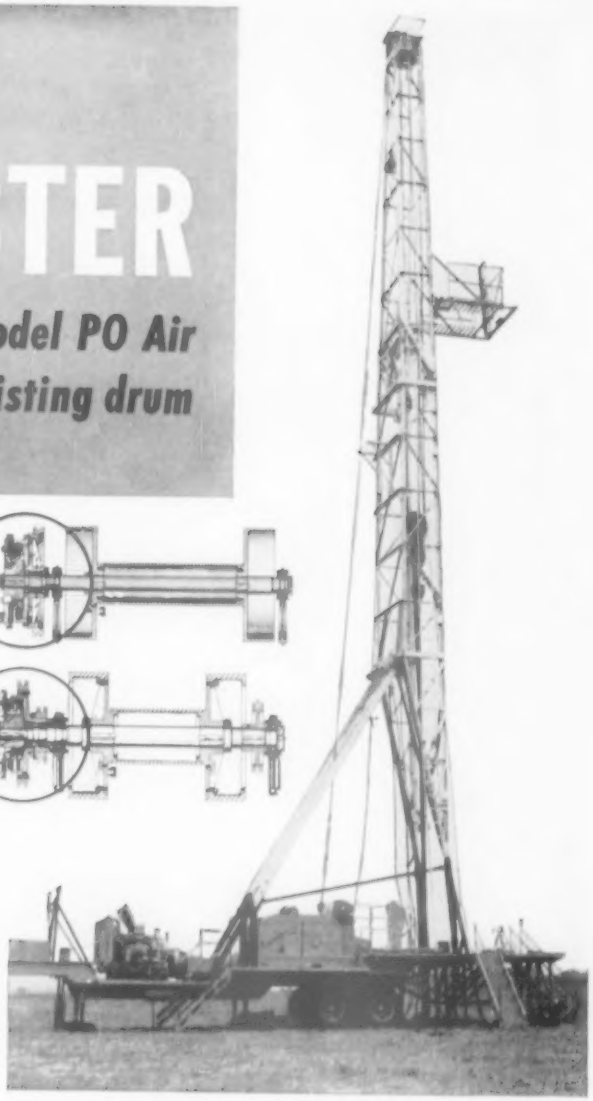
Failing Stratmaster "Ready for the Road"

Failing STRATMASTER

standardizes on Twin Disc Model PO Air Clutches for sand reel and hoisting drum







A new portable slim hole drilling rig—the Failing Stratmaster—is causing considerable comment throughout the drilling industry. It is designed for mobility, rapid rig-up and tear-down—without sacrifice in strength, performance and flexibility. It is trailer-mounted for drilling depths up to 6500 feet.

To get higher capacity, yet lighter weight and more compact control of power transmission without complicated linkage, Twin Disc Models PO-118 and PO-218 Air Clutches are *standard equipment* on the sand reel and hoisting drum, respectively.

Oil field proven, PO Air Clutches provide many other advantages including *higher torque capacity* (up to 126,600 lbs. ft.) . . . *more compact installation . . . faster, smoother operation* under all conditions . . . *positive, quick release*—no seal drag—built in pressure release valves.

Design the Twin Disc Model PO into your new rigs—or install them on old ones! For more information, contact the Twin Disc District Office nearest you . . . Tulsa: Enterprise Building, Sixth and Boston, Gibson 7-1578. Dallas: 1511 Turtle Creek Boulevard, Riverside 3014. Los Angeles: 2950 Leonis Boulevard, Logan 8-3309.

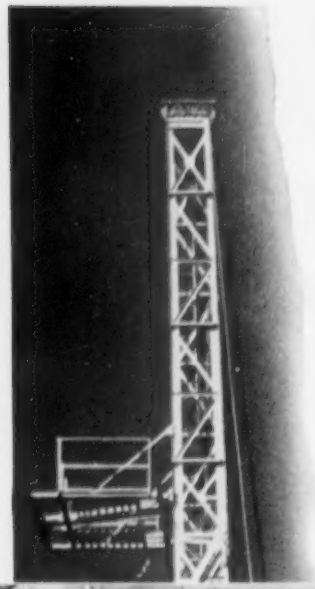
TWIN DISC

TWIN DISC

Friction Clutches and Fluid Drives

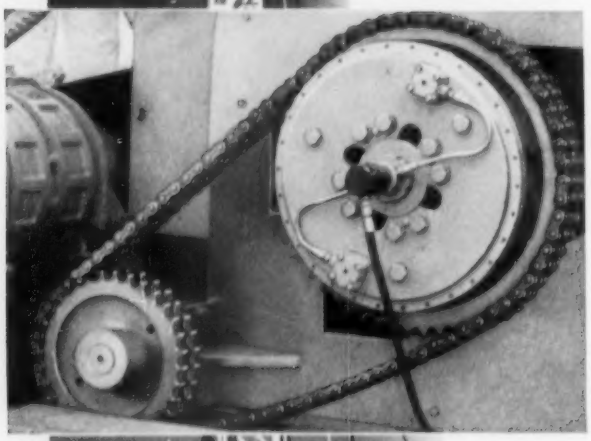
TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES OR SALES ENGINEERING OFFICES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • TULSA



NEW FAILING STRATMASTER EQUIPPED WITH DEPENDABLE DIAMOND ROLLER CHAINS

DIAMOND



New efficiency, light weight and simplicity of operation cut costs and speed drilling on the new George E. Failing Stratmaster.

On the drawworks, Diamond Roller Chains maintain highest efficiency and provide maximum operating life with minimum service.

The continued preference for Diamond Roller Chain by leading rig manufacturers and drilling contractors is evidence that superior Diamond quality provides the dependability and efficiency to keep drilling costs down.

DIAMOND CHAIN COMPANY, Inc.

Where High Quality is Traditional

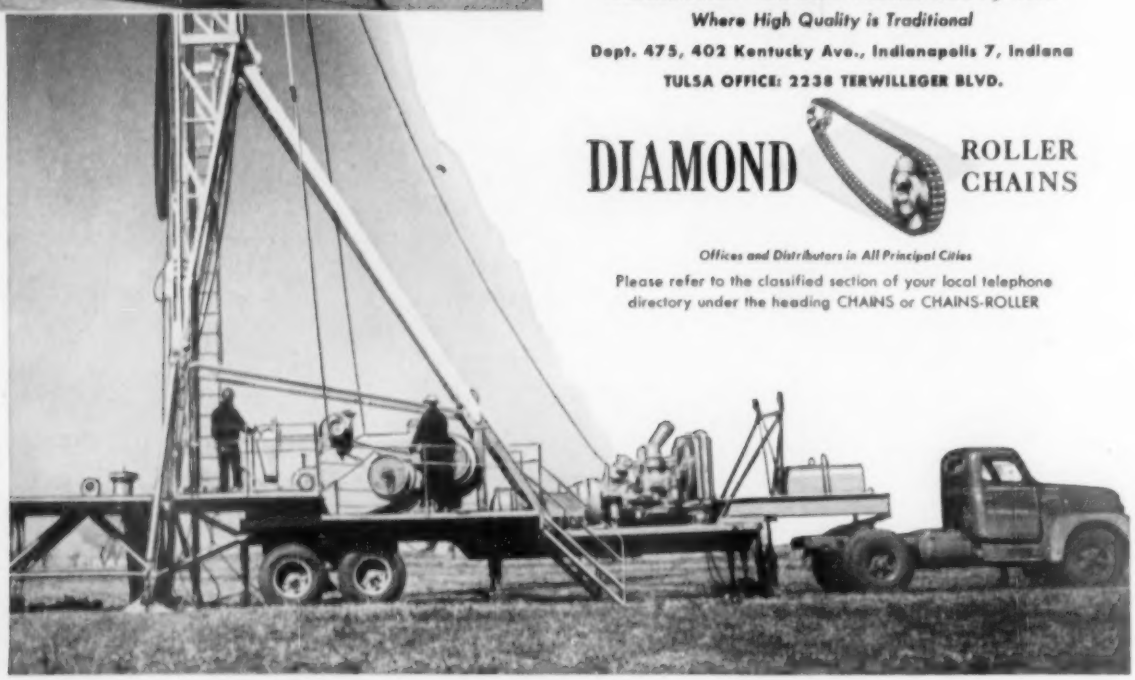
Dept. 475, 402 Kentucky Ave., Indianapolis 7, Indiana

TULSA OFFICE: 2238 TERWILLEGER BLVD.

DIAMOND ROLLER CHAINS

Offices and Distributors in All Principal Cities

Please refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER



Cummins LRI, NVHS, VT-12; Deetz BA8M517; Fairbanks 38F5-1/4; Gardner 6-13; Hall-Scott V-12; LeRoi H-1500, H-200; M.A.N. 5WV-175/122-A; Mercedes-Benz MB836-B, MG836-BG; MGO V8S, V12; Murphy 24, 122, 322; Paxman V6RPHXL; Sauer; Sterling V-D6; Waukesha NKD, NKR, NKDS, LRD.

This new series is planned around a simple basic unit, with easy-to-add components which produce 10 specific models. This arrangement permits extreme flexibility and speedy interchange of components to provide a model specifically adapted to a wide variety of applications.

The 13,800 Series provides two output arrangements. There is one standard output shaft assembly dsigned for maximum side-pull loads up to the full capacity of the converter. On this type output shaft assembly, an output governor take off is available. There is also one standard output flange designed for universal joint or flexible gear coupling drive.

There are three input arrangements provided. A spider drive, incorporating a rubber block drive; clutch assembly; and independent mounting.

In addition to being offered in 10 different models, this new torque converter can be adapted, with appropriate engine speeds, to all engines in the 60 to 600-hp. range by internal blading variations, by either changing the blade angle or by varying the number of blades. **For more information write or call: Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill.**

•

Mealpack Delivers Hot Food to Field Workers

Whenever and wherever food must follow workers in the field, in plants, or on large construction jobs, a Mealpack container makes it possible to prepare a hot meal at a centralized kitchen and deliver it steaming-hot miles away and hours later.

It is possible to keep a complete meal including meat, two vegetables, rolls, and dessert for hours after cooking. All the original cooking heat is sealed in, preserving food colors, flavors, and moistures.

The photograph shows the stainless steel Mealpack container with special Pyrex dish. Lower left-hand photo shows container locked and ready for transporting to a hungry worker. Lower right-hand photo illustrates stainless steel dish lid that holds flavors in and carries hot rolls and dessert with utensils. **For more information write or call: Mealpack Corp., 2014 Ridge Avenue, Evanston, Ill.**

Hi-eF Purifier Designed For Exhaust Steam Reuse

A new, receiver-type Hi-eF purifier has been designed for purifying exhaust steam so that it can be reused for heat exchangers, unit heaters, or for heating of condensate.

All condensate, oil droplets, and other mist entrainment is intercepted from exhaust steam by means of a two-stage principle of separation incorporated into the receiver. In the first stage, the velocity of the exhaust steam is suddenly reduced as it enters the drum of the receiver. This sudden reduction in velocity, combined with the properly designed drum, drops out the larger drop-

FAILING CHOSE Foster Catheads! FOR THE STRATMASTER

We are mighty proud that the George E. Failing Company selected Foster Midget Master Catheads as standard equipment on their new Stratmaster Slim Hole rig. This new 6,500′ drilling rig teamed with Foster Midget Masters will deliver maximum efficiency with minimum overhead expense.

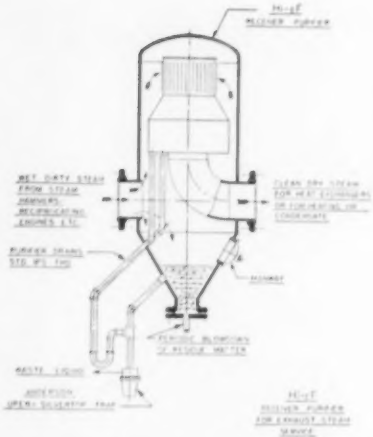
Foster CATHEAD COMPANY
P. O. BOX 1351 WICHITA FALLS, TEXAS
2101 GRANT ST PHONE 2-8651
SOLD AND SERVICED BY

F. M. Farrier	Wichita Falls, Texas	W. O. Nelson	Farmington, New Mexico
Peck Sales & Service	Houston, Texas	Coastal Engineering Co.	Bakersfield, California
Tillery & Parks	Odessa, Texas	Moore Specialty Company	Casper, Wyoming
Garlick Sales & Service	Oklahoma City, Oklahoma	Drexel Canadian Eqpt., Ltd.	Edmonton, Alberta, Canada
Texas Warehouse Service	Corpus Christi, Texas	Northern Well Equipment Co.	Tioga, North Dakota
R. D. Cloninger	Lafayette, Louisiana	Langley Y Cia Srl	Buenos Aires, Argentina
L. W. Mauck	Great Bend, Kansas	Joe Perry	Salem, Illinois

lets of condensate and other material. Then the exhaust steam is guided through a multistage separating element which removes the fine mist by utilizing controlled centrifugal action. Throughout the entire receiver the exhaust steam and removed liquid is continuously guided for maximum separating efficiency. This factor assures the production of clean dry steam and eliminates any possibility of carryover of condensate under normal operating conditions.

The sketch illustrates the special conical-hopper bottom of the receiver purifiers used for this service. This special design permits the heavy material to be collected in the hopper for periodic blowdown. Liquid is continuously drained by an Anderson trap.

The manufacturer fabricates a complete line of these units for pipeline sizes from 4 to 16 in., for pressures up to 300 psig., and with various inlet and outlet arrangements. **For more information write or call: V. D. Anderson Co., 1935 West Ninety-sixth Street, Cleveland 2, Ohio.**



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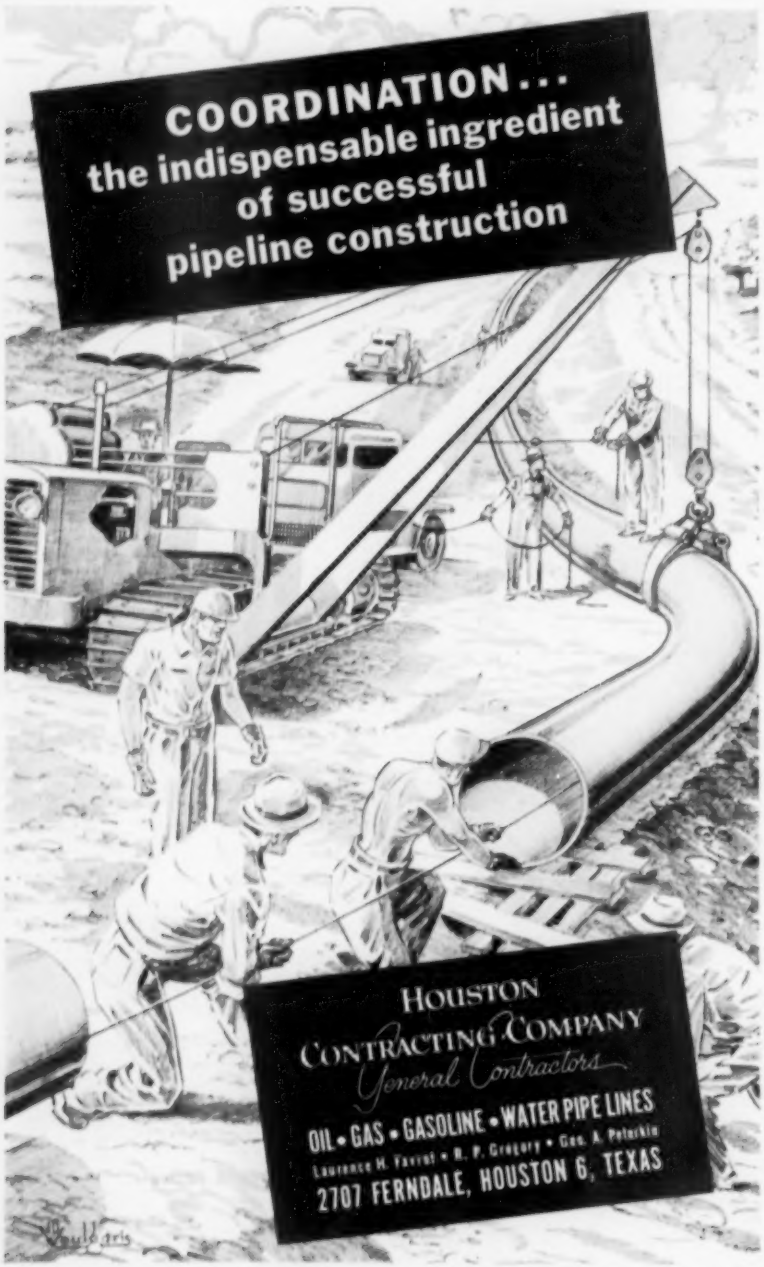
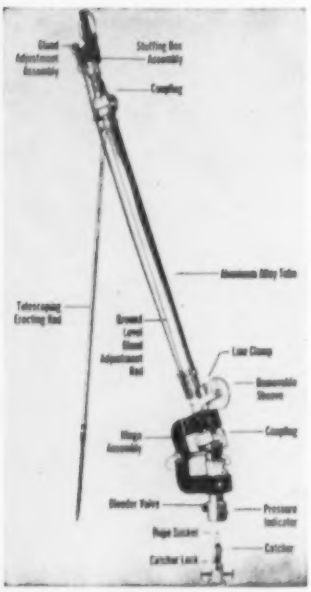




Lubricator Made For Pulling Chokes, Plugs, Wax Scraping

For pulling plugs, chokes, and for wax scraping, this lubricator has 4 ft. of 2⅞-in. o.d. and 2.44-in. i.d. seamless-steel tube on the lower end with any length up to 8 ft. of 2⅜-in. o.d. and 1.939-in. i.d. aluminum-alloy tube above with 9¼ in. sheaves. The lower Unibolt is 2½ in. and the upper Unibolt is 2 in. Pressure rating is 4,102 psi. at 125° F. with a safety factor of 2. Extensions are available for greater length.

The lubricator also has all the features of the regulator lubricator. The aluminum-alloy tube is 3½-in. o.d. and 3.068-in. i.d. by 13 ft. long and has a pressure rating of 2,300 psi. at 125°

F. with a safety factor of 2. A Kobe catcher assembly attached to a small airplane cable and a catcher-locking device are furnished. In operation, the catcher-locking assembly is bolted to the four-way valve and the lubricator is made up with the catcher assembly screwed to the cable-rope socket. The catcher is lowered and locked in place by the hand screws located on the outside of the catcher-locking assembly.

When the pump is caught in the catcher, the hand screws are released and the pump is pulled up into the lubricator. The valve located directly above the catcher-locking assembly is closed. All of the oil in the lubricator can be drained off through the bleeder valve on the lubricator, thus eliminating all clean-up operations after pulling a pump. **For more information write or call: Dale Co., 1237 West Fifteenth Street, Long Beach 13, Calif.**

•

New Republic Plug Valves Feature Plunger Seating

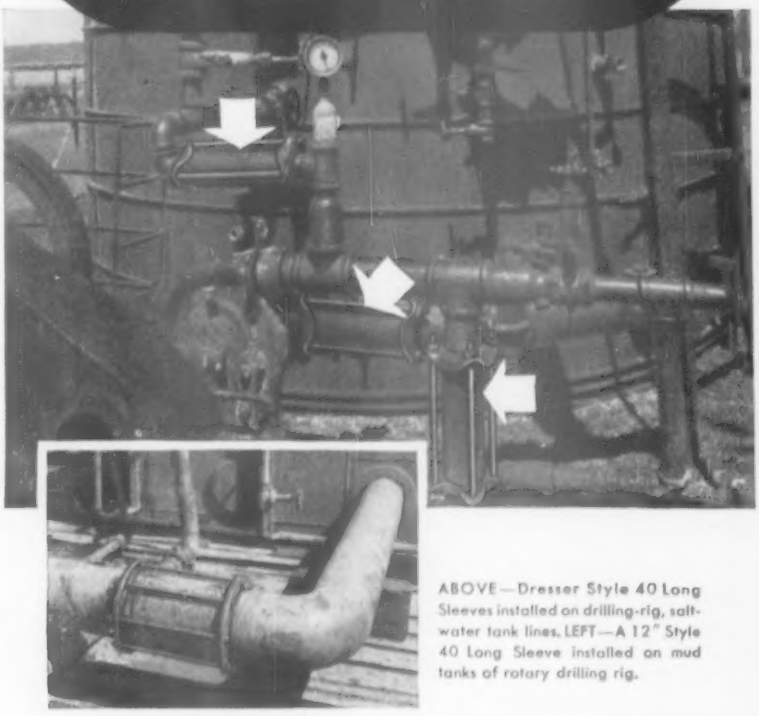
Abrasive slurries and solids in suspension are efficiently handled by this new Republic plug valve.

Construction of this valve is somewhat similar to the simple plug valve, except that seating force on the plug is applied manually. Turning torque is very low since the plug is turned only after being raised from its seat.

The plug is coated with tough synthetic rubber, which provides a positive leakproof seal. Oil or grease is unnecessary for sealing, or to reduce friction. Absence of lubricant means there is no contamination of the products passing through the valve, and no routine servicing is required.

The valve is actuated by two han-

around a drilling rig...
the DRESSER way
is easier...surer!



ABOVE—Dresser Style 40 Long Sleeves installed on drilling-rig, salt-water tank lines. LEFT—A 12" Style 40 Long Sleeve installed on mud tanks of rotary drilling rig.

You'll find plenty of uses for Dresser Couplings and Long Sleeves around a drilling rig . . . or anywhere else you're joining pipe.

No pipe threading is necessary and the only tool you need is a wrench. Dresser Couplings are that simple to make up. You get a permanent bottle-tight connection every time—even on offset or deflected pipe.

AVAILABLE AT LEADING OILFIELD SUPPLY STORES

Style 38 Coupling | Style 40 Long Sleeve | Hydrepair*Asbestos Cement Pipe Clamp | Style 63 Expansion Joint | Style 39 Insulating Coupling

*HYDREPAIR is a trade-mark of Dresser Manufacturing Division

DRESSER®

ONE OF THE DRESSER INDUSTRIES

Dresser Manufacturing Division, 49 Fisher Ave., Bradford, Pa.
Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Airport Blvd., S. San Francisco, Calif.

dles. A quarter turn of the lower handle raises the plug from its seat, providing clearance. While raised, it is turned with the upper handle for the desired flow pattern. The plug is then lowered vertically to the seat, again giving a positive seal. Any solids trapped between seat and plug are pressed into the rubber. When pressure is released by raising the plug, the compressed rubber surrounding the particles pushes these solids out into the flow stream.

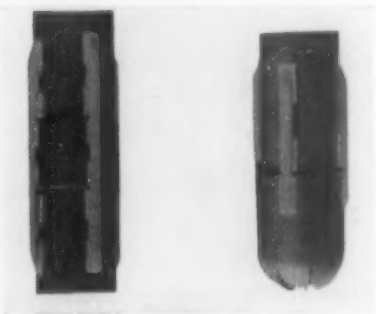
The valve is built of semisteel, with the plug covered by a blanket of synthetic rubber, the compound of which may be varied to meet the requirements determined by the service. The shaft is packed, and the body is sealed with O-rings. Heavy flanges extend the service range up to 200 psi. **For more information write or call: Republic Manufacturing Co., 15655 Brookpark Road, Cleveland 11, Ohio.**

"16 TONS . . .
and what d'you get?"
AVAILABLE NOW
STREAMLINED TUBING BLOCK
With Spring Loaded Duplex Hook
Large diameter, soft acting spring smoothly lifts stand clear of collar.
Widespread duplex hook for easy elevator operation locks in six convenient positions, swivels freely on roller thrust bearing.
Short overall length, extra weight and balance.
McKissick's patented E-Z opening guards conveniently expose sheave cluster for easy reeving — no bolts to pull out and lose.
Two or three sheaves — 14", 17", 20", and 24" diameter, 25 to 100 Tons Capacity.
McKISSICK
McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

900 Cu. Ft. Per Minute Unit Expands Gyro-Flo Line

Weighing only 14,340 lb. ready to go, the Gyro-Flo 900-cu.-ft.-per-minute portable rotary compressor is only slightly larger than the Gyro-Flo 600. It is driven by the General Motors Series 110 diesel engine. The design of this six-cylinder engine enables it to maintain rated brake horsepower at high altitude, and its 24-volt battery and ether-capsule system permits sure-fire starting at extremely low temperatures.

This new 900 size is built to rugged and durable standards. Delivering full 900 cu. ft. per minute at 100 psi., the Gyro-Flo has ample capacity to operate 10 jackhammers or 7 wagon jacks (with light drifters) or 3 wagon drills (with heavy drifters). **For more information write or call: Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.**



Stabilock Improves Primary Cementing

Stabilock provides an improved means for (1) holding the casing away from the formation for an equalized cement column; and (2) locking the casing joints together to prevent breaking off or unscrewing during further drilling operations.

Greatly improved primary cement jobs on surface casing and protection strings result from the proper use of reciprocating or rotating scratchers in combination with Stabilock.

Stabilock, a straddle type, is welded into place over the casing coupling, locking the casing joints together. Stabilock, short type, is welded into place where the casing joint meets the guide shoes, and Stabilock, long type, ties the float collar, second casing joint, and casing coupling together. **For more information write or call: B & W, Inc., P. O. Box 5266, Houston 12, Tex.**

OIL AND GAS JOURNAL

Showcase

- BULLETINS
- CATALOGS
- BROCHURES

Smithway 5th Wheel Trailer Suspension Bulletin T-1 describes design features of the 5th wheel suspension for truck trailers. Giant-sized, synthetic O-rings are used instead of heavy steel springs. This fact, plus other design features, results in weight savings of approximately 400 lb. **For more information write or call: A. O. Smith Corp., Truck & Trailer Products, 5715 Smithway Street, Los Angeles 22, Calif.**

•

Bottle Oilers, Oil Cups, Constant-Level Oil Control. A new and completely illustrated four-page circular, No. 580, describes a line of Alvor constant-level oil controls; bottle oilers for plain bearing lubrication; Sentinel, Royal, and Pioneer glass-body oil cups; and Alsen aluminum-body oil cups. The circular includes detailed dimensions and installation instructions covering a wide range of applications. **For more information write or call: Lunkenheimer Co., P. O. Box 360, Cincinnati 14, Ohio.**

•

Carboline Neoprene W is a new four-page color bulletin on an economical single-package synthetic-rubber coating, for use in corrosive atmospheres in general plant maintenance. This new bulletin clearly lists the basic characteristics of Neoprene W including uses, ease of application, versatility, abrasion resistance, and weathering properties. A section on economy discusses the importance of coating selection based on cost per square foot per year of service. Chemical resistance data is also shown. **For more information write or call: Carboline Co., 331 Thornton Avenue, St. Louis 19, Mo.**

•

Six-Wheel Trucks. Full information on six-wheel trucks, both conventional and cab-over-engine models, is contained in a new 24-page catalog (Form CR-860-E). Full-color and two-color treatment is employed throughout the book to present design and operating features of the line, which includes S-line, R-line, and CO models, powered by gasoline, diesel, or LPG engines. These six-wheelers range in gross vehicle weight ratings from 22,000 to 60,000 lb., and in gross combination weight ratings from 35,000 to 65,000 lb. **For more information write or call: International Harvester Co., 180 North Michigan Avenue, Chicago 1, Ill.**

•

The Pressure-Volume Analyzer Oil Well Testing Method. This new multicolor brochure illustrates and describes the instruments and equipment, instructions, and personnel available to render a new well-testing system. Pressure-volume analysis is an addition to normal formation tests. New information available to the operator through this method includes: rate of change of wellhead pressure, volume of oil or gas produced at the surface or collected in drill pipe, gas-oil ratio, early detection of gas during test, determination of well potential, determination of safe producing rates, gravity, bottom-hole temperature, and percentage of oil, gas, and salt water in recovered fluids. **For more information write or call: Engineering Products, Inc., 600 East Fourth Street, Tulsa 3, Okla.**

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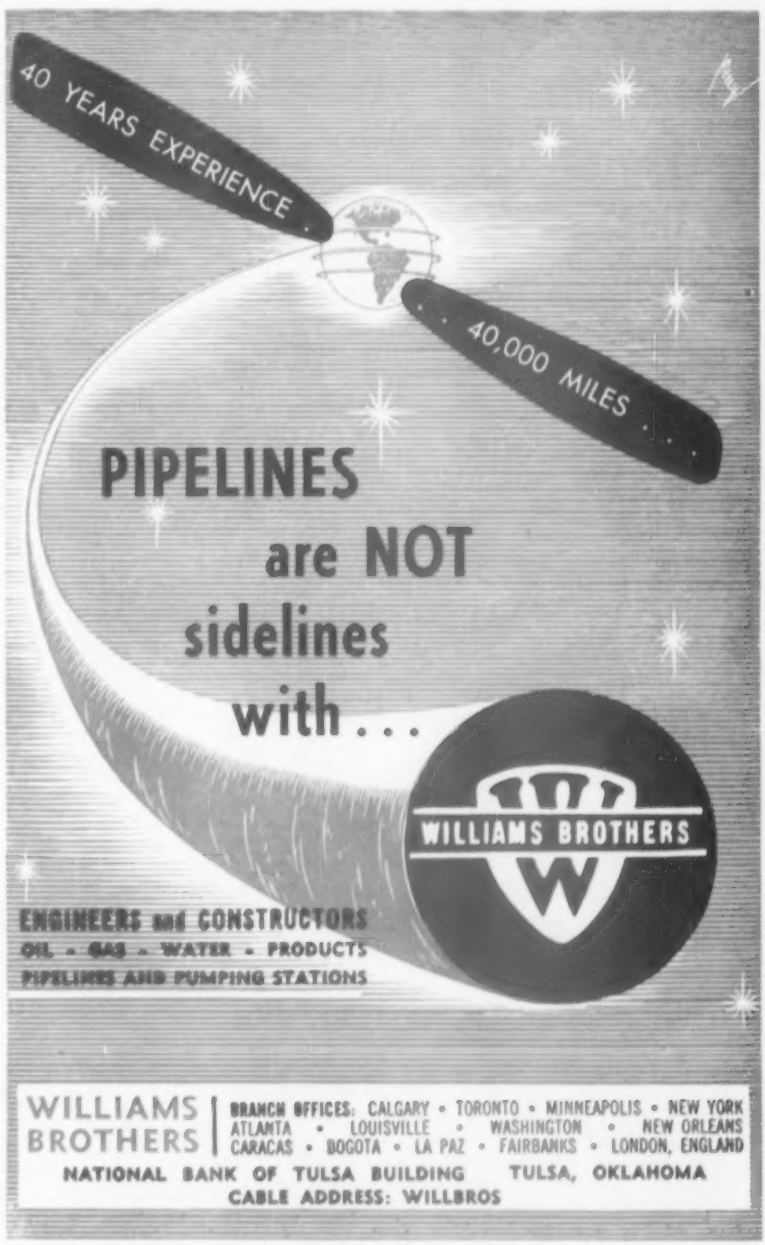
Mercury - Switch - Equipped Controls. 52-page Catalog 856, covers a com-


40 YEARS EXPERIENCE . . .
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CABLE ADDRESS: WILLBROS

plete line of pressure, differential pressure, temperature, liquid-level, limit, and oil-burner controls; thermostats, transformers, and relays. In addition to illustrations of each piece of equipment, charts show operating ranges, adjustments, differentials, and electrical ratings. **For more information write or call: The Mercoid Corp., 4201 Belmont Ave., Chicago 41, Ill.**

●

Straightway Diaphragm Valve. Frictional resistance to flow, simple maintenance, self-draining feature, and a selection of materials for valve bodies, linings, diaphragms, and bonnets are among the features of this four-page bulletin. A cutaway drawing illustrates the simplicity of design and operation of this line of valves with straight-through flow for viscous materials and slurries. **For more information write or call: Grinnell Co., Inc., 260 West Exchange St., Providence 1, R. I.**

●

Engineered Special-Hazard Fire Protection. This new highly illustrated Catalog 73 covers the various generally accepted methods of fire detection, prevention, control, and extinguishment associated with the field of special-hazard fire protection in processing plants. Fire-fog, airfoam, high pressure CO_2, low pressure CO_2, and dry-chemical methods are all discussed. **For more information write or call: Automatic Sprinkler Corp. of America, Youngstown 1, Ohio.**

●

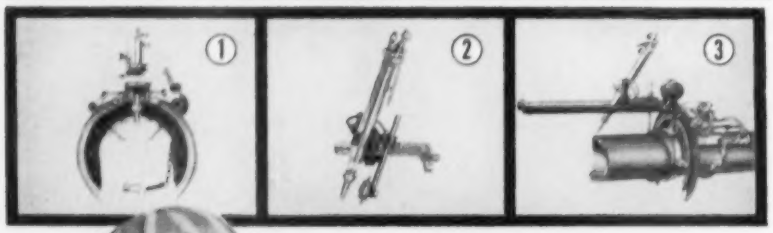
Comparison of Carbon and Alloy Steels for Pressure Vessels notes that in general the alloy steels exhibit higher allowable tensile strength in the —20° to 650° F. range; and that as temperature increases, allowable tensile strength decreases at various rates for the various steels. This behavior implies that among the steels under consideration for pressure vessels, there is an optimum steel with respect to savings in either weight or cost, which are the two major advantages offered by alloy steels in the —20° to 950° F. range. Of the nine graphs included in the booklet, the first plots allowable stress against temperature for the various carbon and alloy steels under discussion. The remaining eight graphs are paired according to maximum service temperatures in increments of 100 from 650° to 950° F. **For more information write or call: Lukens Steel Co., Coatesville, Pa.**

●

Ketjen, Catalyst, and Oil Cracking, a 12-page booklet, describes the facilities of a European plant licensed under American Cyanamid Co. patents to manufacture fluid-cracking catalyst for the petroleum-processing industry, particularly those refineries located in the Eastern Hemisphere. **For more information write or call: C. R. J. Besseling, Nederlandsch Verkoopkantoor voor Chemische Producten, N. V., Amsterdam, Mauritskade 63, P.O.B. 4038, Holland.**

●

Thermobestos Pipe and Block Insulation is a new 12-page booklet that gives complete information on hydrous calcium silicate insulation for hot outdoor piping and process equipment operating at service temperatures up to 1,200° F. The booklet shows how Thermobestos is made from asbestos, diatomaceous silica, and lime. It explains why this completely inorganic insulation has exceptional strength and extreme lightness; is chemically stable and noninflammable; has low conductivity and is not damaged by water. Additional features in this booklet are the sections on the prefabrication of fittings, physical and thermal properties, and tables of available sizes and thicknesses. Included, too, are complete heat transmission tables for both pipe and block insulation. **For more information write or call: Johns-Manville, 22 East Fortieth Street, New York 16, N. Y.**



For complete pipe cutting and beveling equipment . . . H & M

① **THE H & M MACHINE:** The lightest, semi-automatic pipe beveling machine ever made. Now you can cut and bevel 36" diameter pipe quickly, accurately with the #5 H & M **weighing only 95 lbs.** Proportionate weight reductions in the other H & M cutters and bevelers.

② **OUT-OF-ROUND:** For simple, fool-proof cutting and beveling of out-of-round pipe get the H & M out-of-round attachment, manufactured to fit all H & M Pipe Cutting and Beveling Machines. The roller guide follows the pipe contour . . . the torch follows the roller guide.

③ **SHAPE CUTTING:** You can reduce the time consumed in shape cutting **up to 95%** with H & M semi-automatic shape-cutting equipment. One master template furnished with each shape-cutter. Write for your free copy of "More Profit Dollars for All Types of Pipe Fabrication Work."

Why H & M is the FIRST name in pipe-beveling.

Many have imitated H & M design, but none have found a substitute for H & M quality. Accuracy . . . durability—these are features that are part of the H & M brand. H & M—first in its field . . . and now 40% lighter.

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Difficult Dehydration

problems solved with M-C UNITS in series with Compressors . . .

If you are having difficulties in gas dehydration in conjunction with compression because of: low pressures; high temperatures; flow surges; ground and piping vibrations — Maloney-Crawford has the answer.

Maloney-Crawford Glycol Dehydration units are especially adaptable for use in series with compressors. Because of our experience on many installations involving dehydration upstream, interstage, and downstream of compressors, Maloney-Crawford field engineers are fully qualified to make equipment recommendations on dehydration problems. Proper placement of the dehydrator and advice on pressure control and economical cooling devices can often result in lower initial cost, better dehydration and lower maintenance costs for the gas producer. Our engineers are available to discuss your problems.

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FACTORY AND GENERAL OFFICE: 38 North Peoria—Box 659—Tulsa, Oklahoma
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CANADIAN REPRESENTATIVE: Maloney-Crawford Tank & Service Company, Ltd.—Edmonton.
TEXAS PANHANDLE REPRESENTATIVE: Atlas Tank Company—Pampa, Texas.

MALONEY - CRAWFORD TANK & MFG. CO.

EQUIPMENT MEN . . . in the News

Houston Nomads and Guests Greet New Officers

Ninety-seven Houston Nomads and guests greeted the new administration of Houston Chapter Nomad President W. O. (Bill) Hedrick at College Inn, Monday, February 13. Nomad guests for the evening are shown seated left to right: Bill Boren, Rolo Manufacturing Co.; W. B. Jeter, Hardy-Griffin Co.; H. R. Stephen, National Supply Co.; Warren Baker, editorial director, World Oil; Jorge T. Lavandez, Coper, Ltd., Lapaz, Bolivia; Gene LaSchober, Jr., Bethlehem Steel Co.; George R. Grim, Jr., Manabi Exploration, Ecuador; Dewey Clark, Southeastern Asia Drilling Co. Standing left to right: W. O. (Bill) Hedrick, president; F. B. Allary, Cameron Iron Works, Dallas; J. M. Gray, McCullough Tool Co.; John Hardy, Hardy-Griffin; Cecil Smith, Gulf Publishing Co.; B. Stark, Cameron Iron Works; Fred Buckner, Byron Jackson, Lake Charles; E. O. Koberg, Byron Jackson; Eduardo Rugamo, Mexico D. F.; Horacio De la Concha, Cameron Iron Works; and Stan Kazar, Hutchinson Manufacturing Co.

McBrien Is Houston Manager For Midwestern Pipeline

JAMES McBRIEN

The appointment of James McBrien as branch manager in Houston for Midwestern Pipeline Products Co. of Tulsa has been announced by John Wilson, sales manager. McBrien joined Midwestern in 1955 as sales representative and service engineer and since has been working with pipeline companies and contractors in the Gulf Coast area.

Before joining Midwestern, McBrien was corrosion engineer for Great Lakes Pipe Line Co. and sales and service engineer for T. D. Williamson, Inc.

Peerless Scrubosphere Studied by Sales Personnel

A new type of separator, designed to remove dust particles from natural-gas pipelines, was the topic of a 2-day national sales conference held recently by Peerless Manufacturing Co. of Dallas. Don Sellers, Peerless executive vice president, described the Scrubosphere and stated that it is scheduled for immediate marketing.

More than 40 sales representatives present toured Peerless' laboratory facilities. The group witnessed the Scrubosphere in simulated compressor-station operations. Harold Lowdon, development engineer for Peerless, was in charge of the demonstrations.

Oilwell Appoints Three, Opens Canadian Store

Appointments of Stanley D. Strand as city representative at Calgary, Garth V. Evans as manager of the Drayton Valley, Alta., store, and Alex Balash as field representative at Drayton Valley have been announced by W. A. Weir, Canadian area manager of U. S. Steel's Oil Well Supply Division. Weir also announced the opening of a new oil-well-equipment and supply store at Estevan, Sask. The new store is under the supervision of B. H. Ravanell, district manager, Edmonton, Alta. Manager of the store is Robert J. Mitchell and field representative is Joseph G. Walsh.

Strand joined Oilwell in 1948, became store manager at Edmonton in 1951, and field representative in 1953. Prior to his present appointment, Evans had been field representative at Edmonton since 1952. Balash was employed by Oilwell in 1954 at Edmonton, where he was located prior to his present appointment.

Mitchell, who came to Oilwell in 1951, has served as field representative at Swift Current and Virden, Canada. Walsh joined the division in 1952. In July 1955 he was transferred to Virden, remaining there until his recent appointment.

Officers and Directors Elected By Mission

At a meeting in Houston in February, stockholders of Mission Manufacturing Co. elected officers and directors for the coming year.

W. B. Sharp was elected chairman of the board and president. Richard E. White was named executive vice president and Anan Golub vice president, secretary and treasurer.

Other directors included W. T. Campbell, D. C. Sharp, Jr., and Ross Bennett.

Core Lab Names Cusator As Shreveport District Head

The appointment of James A. Cusator as manager of the Shreveport district has been announced by Core Laboratories, Inc. Until recently, Cusator served as assistant district engineer for Core Lab's entire 10-state Rocky Mountain region, assuming direct responsibility for all field and laboratory operations.

In his new position, Cusator will direct Core Lab's integrated reservoir engineering services throughout East Texas, North Louisiana, and Arkansas from offices in Shreveport.

30-In. Wheatley Valves Scheduled for Delivery

Pictured are three Frank Wheatley 30-in. steel check valves, scheduled for installation along Texas Eastern Transmission Corp.'s oil and gas lines which originate in Texas, terminate in Louisiana. Each valve weighs 11,100 lb., largest valves of this type ever manufactured in the Mid-Continent area. The valve on the left is completed, the next in the later stage of assembly, and the last being hydrostatically tested at 2,175 psi. These check valves are part of a special order for fifty 20, 24, and 30-in. valves produced by Frank Wheatley Pump & Valve Manufacturing Co., Tulsa.

Goodall Rubber Co. Enlarges Plant and Offices

Goodall Rubber Co. of Texas has enlarged its Houston plant and office by 8,000 sq. ft. The addition includes a new warehouse and enlarged repair facilities as well as increased office space. Goodall manufactures rotary hose and carries a full stock of rubber goods. The Goodall Repair Service, which converts damaged Goodall rotary hose into vibrator hose, is also maintained here.

Well Equipment Makes Stunkard Area Manager

Ted Stunkard has been appointed sales representative for the Kansas area for Well Equipment Manufacturing Corp., according to John Gates, Weco sales manager. Stunkard will be located in Great Bend, Kans.

Before joining Weco, Stunkard was with American Tank Co., Creekmore Drilling Co., and United Supply Co. Prior to taking up his sales duties, he spent 30 days in Weco's Houston plant getting first hand knowledge of Weco unions, blocks, and compounds. As a Weco representative, Stunkard will also

Beaird Purchases Butler LP-Gas System Division

Purchase of the LP-Gas system division and manufacturing facilities of Butler Manufacturing Co. at Galesburg, Ill., by The J. B. Beaird Co., Inc., of Shreveport, La., producers of LP-Gas systems, has been announced by J. Pat Beaird, president.

The purchase includes raw materials and finished-goods inventories of the Blue Belle system, as well as assumption of Butler's standard-products warranty and all manufacturing rights to the Blue Belle system. Beaird also announced that a new manufacturing plant, utilizing Butler equipment and modern machinery for producing LP-Gas systems, will be built immediately in the general Galesburg vicinity.

The midwestern plant will add new scope to Beaird's five integrated divisions whose products are sold on an international scale under the direction of J. L. Tullis, vice president and general manager of sales. Coordination of Butler's midwestern distribution into Beaird's nation-wide LP-Gas sales organization will be handled by Richard M. Meisenbach, manager of LP-Gas and NH-3 equipment sales.

J. Pat Beaird, president of The J. B. Beaird Co., Inc., signs agreement to purchase the LP-Gas systems division facilities of Butler Manufacturing Co., whose Vice President Glen A. Speakman is shown witnessing the sale.

Announcing the improved
TYPE "Z"
WmSEAL CASING
BUSHING
STAINLESS STEEL CLAMPS ARE HAND TIGHTENED, NO TOOLS REQUIRED
SOLID RING OF TOUGH SYNTHETIC RUBBER — NO JOINT
TIGHTER SEAL WITH WIDE STAINLESS STEEL BANDS AND CLAMPS
"Z" BUSHINGS STAY PUT EVEN IF PIPE MOVES IN CASING
COMPLETE CORROSION RESISTANCE
NO SHIELD REQUIRED
WmSEAL "Z" BUSHINGS ARE AVAILABLE FOR 4" SIZE AND LARGER PIPE
NON-SKID TEETH ON EXTRA LONG SKIRT HOLD BUSHING FAST TO CASING
EXTRA THICK "SHOULDER" (TOUGH SYNTHETIC RUBBER) CANNOT CUT THROUGH EDGE OF CASING

T. D. Williamson, Inc.

P. O. BOX 4038 TULSA 9, OKLAHOMA

REPRESENTATIVES: Houston • Pittsburgh • Plainfield, N. J. • Amarillo • Casper • Provo, Utah • Joliet, Illinois • Los Angeles • San Francisco • Bartlesville, Okla. • Edmonton • London, Ontario • Calgary • Buenos Aires • Durban, Natal, South Africa

DRINKS UP MOISTURE!

How PLS Oven-Drying Conditions Steel Pipe for More Effective Protection

The protection on steel pipe for underground service can be only as good as the bond between the pipe and the protective materials applied. That's why PLS engineers go all out to make sure that pipe surfaces are properly conditioned for primer application.

Through scientifically-controlled warming and drying ovens like this, moisture is removed from the pipe. The warming process tends to expand pipe surfaces to assure better primer coverage, and to eliminate temperature differentials between the pipe and the hot-applied coatings. All this extra care at the start is the key to the proper bond for more uniform, longer-lasting protection.

PLS

Dependable Service since 1931

PIPE LINE SERVICE CORPORATION

Pioneers in Steel Pipe Protection

General Offices and Plant: — Franklin Park, Illinois

Plants also at Glenwillard, Penna.; Greggton (Longview), Texas; Corpus Christi, Texas; Harvey, La.; Sparrows Point, Md.; Monmouth Junction, N. J.; and Provo, Utah.

represent Chiksan Co. for swivel joints, steel rotary hoses, and mud guns.

Habzda Heads Industrial Engine Sales for White

M. L. HABZDA

M. L. Habzda has been named supervisor of industrial and general-account sales in the service division of White Motor Co., it has been announced by P. E. Tobin, general sales manager. Habzda is responsible for the sales development of the White industrial-engine program and is working with the field organization of the company in promoting sales of White Mustang engines for industrial, marine and other engine applications.

Habzda has been associated with White for 3 years in the service department, handling warranty and field-service problems and participated in the White maintenance-management program of refresher training courses for supervisory maintenance personnel throughout the country.

E. D. Bullard Co. Makes O'Donnell Sales Manager

The appointment of Paul W. O'Donnell as sales manager has been announced by E. W. Bullard, Jr., vice president in charge of sales for E. D. Bullard Co., San Francisco, manufacturer of industrial safety equipment.

O'Donnell joined Bullard as industrial relations manager in 1952 and has been in charge of distributor sales east of the Mississippi since that time. His new duties will include management of all company distributor sales throughout the United States and Canada. O'Donnell's headquarters for the present time will remain in Chicago.

Werner Is Made Eastern Representative by Monsanto

John L. Werner has been appointed eastern representative of petroleum-chemicals sales for Monsanto Chemical Co.'s organic chemicals division, according to John L. Hammer, Jr., divisional director of marketing. Werner will succeed James B. Irwin who is transferring to the petroleum sales department of Monsanto's Lion Oil Co. division at El Dorado, Ark.

Werner will make his headquarters in New York. He joined the sales department of Monsanto's organic chemicals division in 1946.

Slayton Heads Engineering For Parkersburg-Aetna

C. H. Slayton, Jr. has been named director of engineering of Parkersburg-Aetna Corp. Previous to his new position, Slayton was with General Electric Corp., having served at G. E.'s chemical and metallurgical division and with their aircraft gas turbine division.

Slayton will make his headquarters in Parkersburg, W. Va.

Pauza and Rutherford Are Welex Jet Sales Appointees

Joseph G. (Joe) Pauza has been appointed sales engineer for the Houston district and Bob Rutherford has been named salesman for the Odessa district office of Welex Jet Services, Inc.

Pauza has been in oil-well-service work more than 18 years and has previously worked in radioactive and electrical logging, field perforating, research laboratory work, and sales. Rutherford has been with Welex 1½ years, serving as a rigman in field-service work before his recent promotion.

Quigg Becomes Sales Engineer For Condit

K. E. QUIGG

Appointment of Kenneth E. Quigg, Jr. as sales engineer for Condit Co. has been announced by D. J. Condit. Before joining Condit, Quigg was with the controls division of Black, Sivalls & Bryson Co. as application, field-service and sales engineer.

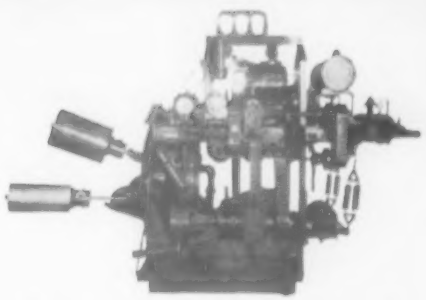
Condit Co., with headquarters in Tulsa, also maintains offices in Kansas City and is a distributor for several lines of process and control equipment.

Handwerk Joins Stearns Rogers Manufacturing

Glenn E. Handwerk, formerly with Blaw-Knox Co., Tulsa and Pittsburgh, has joined the engineering staff of Stearns Roger Manufacturing Co., Denver. Prior to his association with Blaw-Knox, he was employed by the Tulsa division, Gulf Oil Corp.

proved...

efficiency and durability over miles of pipelining



- Coats high welds, wrinkled bends, egged pipe.
- Heated ring prevents dope from "freezing".
- Saves as much as 30% on dope.
- Built in strainer prevents foreign particles from getting to pipe surface.
- Available for all sizes of pipe.

CROSE LINE TRAVELING COATING AND WRAPPING MACHINE

The original spray-ring type coating machine assures positive and uniform coating of pipe. Available with rubber or steel crawler wheels that assure positive traction. Precision-built paper brakes are adjustable to permit perfect tension of paper. Wrapping head is driven by a variable speed gear box which enables the operator to control and maintain the proper lap of wrapping material. For the best in pipeline equipment — Specify CROSE!

M. J. Crose Manufacturing Company, Inc.

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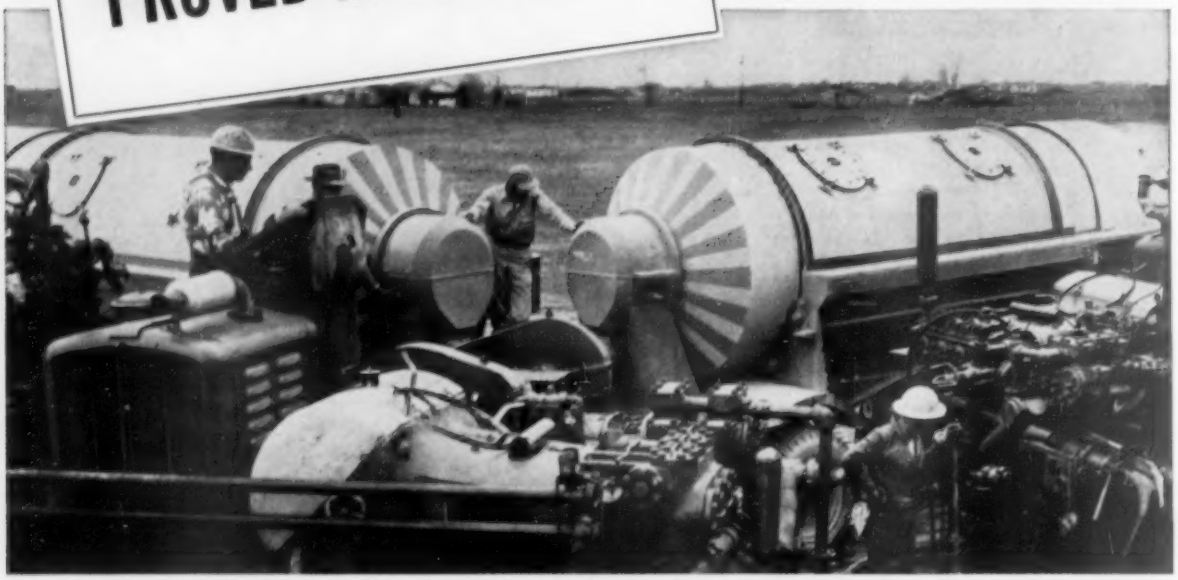
PIPELINE SUPPLY CO., HOUSTON

TESTED in the lab... PROVED in the field...

Here rigid quality control is enforced during the manufacture of Unaflo Oil-Well Cement. Skilled technicians make regular tests to assure uniform performance of Unaflo under field conditions.



Oilmen know Unaflo's quality pays off in reliable field performance. Whether you're on a routine job, or a tough one, you can depend upon Unaflo to give uniformly good performance—every time!

UNAFLO* gives top-to-bottom protection

Start out with the *right* oil-well cement, and you may save money later on. For, when the heat and pressure are high, slurries must go in place trouble-free. That's when Unaflo's advantages show up.

Unaflo slurries pump easily from the start, stay fluid under critical conditions, give you extra time when emergencies arise. Then, after the carefully calculated retarded period, Unaflo gives a strong, tight seal, resistant to sulfate waters.

Follow the example of oilmen who *know* — specify Unaflo, because it's tested in the laboratory and during manufacture to ensure consistent high quality. Unaflo complies with API STD 10A Specifications for oil-well cement, regular type classes D and E. Typical data tables on Unaflo's down-the-well performance and the facts on our other cements are available on request.

*"UNAFLO" is the registered trade-mark of the retarded oil-well cement manufactured by Universal Atlas Cement Company.

MINNEAPOLIS • WACO • KANSAS CITY • BIRMINGHAM • CHICAGO • NEW YORK

Export Distributor: United States Steel Export Co., New York

Universal Atlas Cement Company

UNITED STATES STEEL (USS) CORPORATION SUBSIDIARY

100 Park Avenue, New York 17, N. Y.

OIL-FIELD CEMENTS

Unaflo *Retarded* Oil-Well Cement
Resistant to Sulfate Waters

Atlas Portland Cement—Type I

Atlas Portland Cement—Type II
Resistant to Sulfate Waters

Atlas High-Early Cement—Type III

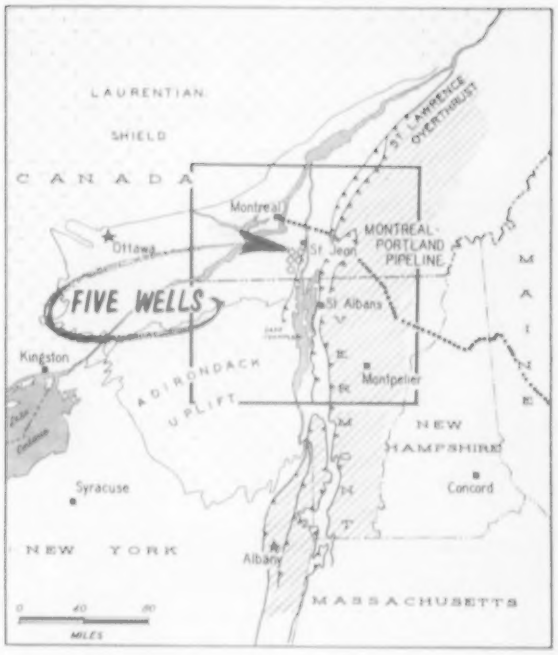
UNITED STATES STEEL HOUR—Televised alternate Wednesdays—See your newspaper for time and station.

OGJ-U-141

EXPLORATION

Want to Be First In Vermont?

by Frank J. Gardner



Successful oil and gas exploration in the St. Lawrence Lowlands of Quebec could mean possible success in two counties of northwestern Vermont.

OIL in Vermont? Could be. It's long been a standing joke in this particular department that "such and such is as far-fetched as oil in Vermont." In the light of recent events we may have to substitute "Maine" for the unlikeliest state.

The new interest in New England oil possibilities stems from gas discoveries just across the Canadian border south of St. Jean, Que. The St. Lawrence Lowlands, a 10,000-sq.-mile area centering around Montreal, has been quietly explored by the drill for the past 2 or 3 years. About 25 wells have been sunk so far, and 3 of them have flowed gas in commercial quantity.

Exploration . . . Four companies now hold exploration concessions from the Province of Quebec. The most active of these has been Eastern Canada Gas & Oil, Ltd., with a 200-sq.-mile concession in St. Johns County. These operators have shut in three gas wells, stuck drill pipe in another after hitting a gas pocket, and lost one potential gasser to fire and salt water. The deepest of these went to 4,750 ft.

Other operators in the Lowlands are Imperial Oil, Ltd.; Oilmont Petroleum; and Great Sweet Grass Petroleum. Ten other companies hold special exploration permits. Imperial, with 600,000 acres, is the largest leaseholder, and has run seismic check all along the south shore of the St. Lawrence River across from Montreal. The company expects to drill ". . . a well or two" in 1956. Its main goal is subsurface information, but a "geological wildcat" that just happens to produce is always a welcome addition to the company books.

In a new basin . . . Haphazard drilling has been going on in the St. Lawrence Lowlands for the past 40 years, but most of it was in search of water. Many wells reported gas flows and oil showings, but not until 1952 did the first serious search for production begin. The region is underlain almost entirely by rocks of Ordovician and Cambrian age, with a total thickness of about 8,000 ft. in front of the St. Lawrence overthrust (see map). The sediments are about 75 per cent limestone and dolomite, 21 per cent shale, and 4 per cent sandstone.

There are, according to Roliff,[1] actually two basins, a large one to the east of Montreal and a smaller one to the west. Oil seeps have been recorded in both basins, and in the larger one (with which we are concerned here), the sediments are thought to be shelf or foreland deposits of Late Cambrian and Early Ordovician age. The regional structure is a broad syncline, trending northeasterly, and it holds anticlines, faults, and lenticular sand bodies, as well as northeastward wedgeouts that could contain sizable oil and gas pools.

Vermonters are watching these Canadian activities very closely, in the hope that production might be extended south into their oil-barren state. The southernmost of Eastern Canada's three gassers is at St. Valentin, only 10 miles north of the border. They are shut in pending further drilling in the field, but Desider Zorgo, consulting geologist and engineer for Eastern Canada, will take you out to visit them if you're up that way. He recently threw one of them wide open for press photographers and the deafening roar was proof enough that a new field had been found. The gas is of top quality, 98.5 per cent methane, ordorless and colorless.

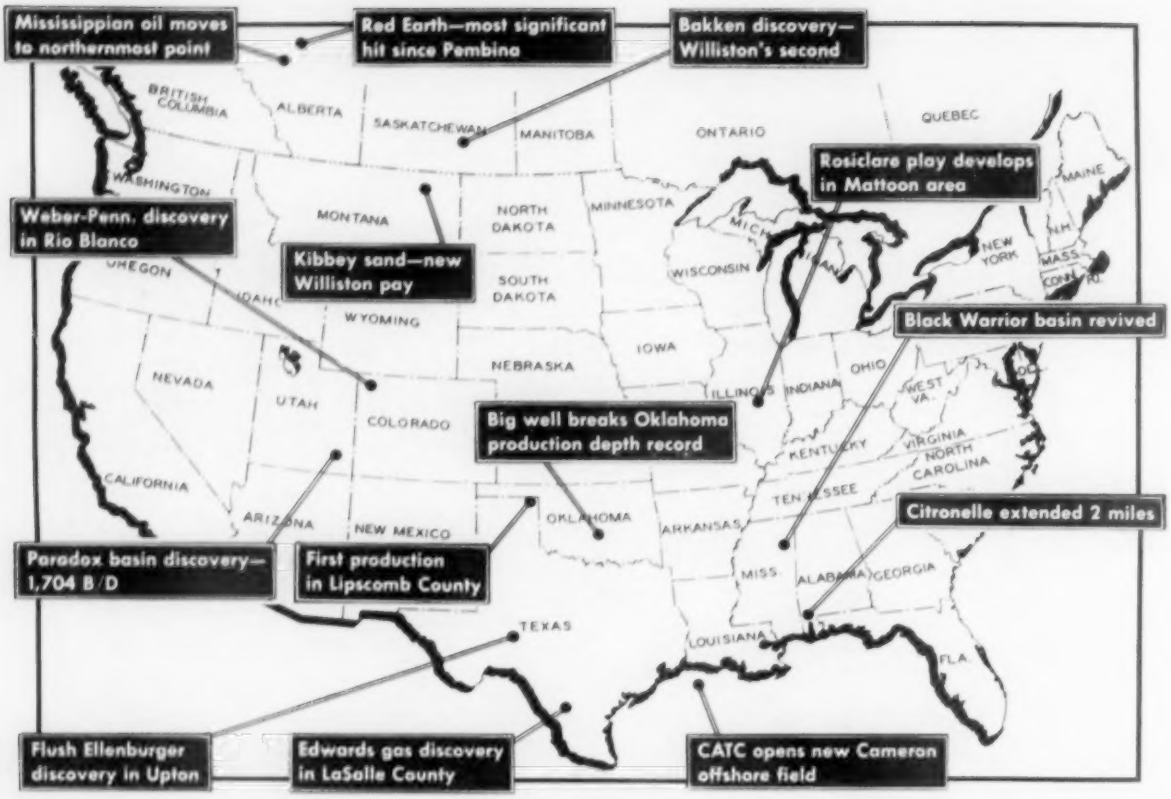
Zorgo's geology is the most heartening encouragement Vermont has yet heard. In his words, the prospective territory includes ". . . a U-shaped basin extending 15 to 20 miles into Vermont from a point beginning approximately 2 miles west of the Richelieu River and thence easterly 12 miles . . . to a point in Missisquoi Bay." This would definitely place Grand Isle and Franklin counties of Vermont and the waters of Lake Champlain in the path of possible production.

Could mean a new oil state . . . Seepage gas has long been noted in water wells of northwestern Vermont. As a recent public interest event following Eastern Canada's success, the Rotary, Kiwanis, and Lions clubs of St. Albans, Vt., staged a demonstration to prove that such accumulations do exist. Three propane cylinders were filled with gas that was drawn off the top of a water-storage tank on a farm nearby. This "first sample of Vermont-produced natural gas" was presented to State Geologist Charles F. Doll. He connected a bunsen burner to one cylinder and it burned with a strong and steady flame.

If oil were found here, it would doubtless be good Penn grade stuff, for the area is a part of the Appalachian geologic province—a marine sedimentary basin not to be ignored. Want to be the first to drill in Vermont?

Reference

1. W. A. Roliff, "Eastern Canada's Six Potential Oil Provinces," The Oil and Gas Journal, August 15, 1955, page 114.



February looms as outstanding month of '56 as . . .

Western Canada Moves Out in Front

by John C. McCaslin

WIDESPREAD discoveries of considerable significance in both the United States and western Canada promised to make the shortest month of the year the best in exploratory success. Red Earth Creek, nominee for the discovery of the month; a new pay for Canada's Williston basin region; and an important Mississippian discovery at South Sturgeon Lake pulled Canada out in front in the 1956 exploratory race. Another Weber sand oil discovery in northwestern Colorado, and a revitalizing strike in the Paradox basin captured U. S. exploratory interest.

Biggest News Since Pembina

Discovery news swept across the Prairie Provinces with excitement not seen since Pembina. Union Oil Co. of California sparked the wildest land rush in western Canada since Redwater days with its granite wash oil discovery at Red Earth Creek, 220 miles northwest of Edmonton in the Peerless Lake region. The important well flowed oil at the rate of 792 bbl. daily on restricted choke during a 2-hour production test. The discovery is the fifth granite wash strike in Canada in the past 18 months.

The hot leasing play that resulted from the Red Earth hit saw 12,538,248 acres of Crown rights issued by the Alberta Department of Mines and Minerals during a 1-month period. Other transactions brought the total to 13,013,566 acres. The land rush extends from Fort Vermilion at the top of Alberta in an arc to Cold Lake on the Saskatchewan border and on into that province for about 150 miles.

Rank Bakken discovery . . . Mobil Oil Co. of Canada, Ltd., opened the first oil production from the Bakken sand (basal Mississippian) in the Canadian portion of the Williston basin.

The discovery well is the 34-9 North Roncott, 28 miles north of the Montana border in Saskatchewan. Nearest production is about 60 miles east at Ralph and about the same distance southeast at Ratcliffe.

Mississippian oil moves north . . . Amerada Petroleum Corp. announced the first successful completion of a Mississippian oil well in the South Sturgeon Lake D3 and Triassic oil field area of northwestern Alberta. The well flowed oil at the rate of 280 bbl. per day. Nearest Mississippian oil production is about 130 miles southeast at East Cynthia.

Paradox Search Revitalized

The search for oil and gas in the Paradox basin of Southeast Utah paid off with the best discovery to date. The Texas Co. completed its 1 Navajo in San Juan County for 1,704 bbl. of oil

WHETHER OPERATING AT HIGH OR LOW ALTITUDES — EXTREMELY DRY OR HUMID CONDITIONS — CSCO PUMPING ENGINES NEED NO MODIFICATIONS OR SPECIAL EQUIPMENT.

Only CSCO Engines have ALL 4 of these important features:

SMOOTH, STEADY OPERATION . . . The CSCO flywheel inertia provides peak power while the oil damped governor holds the throttle steady — permitting the engine to average the demand, up to its full capacity.

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Total February Completions, Exploration, and Development

	Total completions					Total wildcat wells					Cable tool comp.	Active operations
	Total	Oil	Gas	Dry	Footage	Total	Oil	Gas	Dry	Footage		
Alabama	4	1	0	3	30,592	2	0	0	2	15,785	1	15
Arkansas	48	29	0	19	153,612	11	4	0	7	41,530	6	78
California	199	144	3	52	917,692	45	2	0	43	212,403	11	225
Colorado	100	25	7	68	536,811	42	4	0	38	219,399	0	109
Florida	3	0	0	3	14,450	3	0	0	3	14,450	0	0
Georgia	1	0	0	1	4,182	1	0	0	1	4,182	0	3
Idaho	1	0	0	1	3,522	1	0	0	1	3,522	1	0
Illinois	262	124	3	135	639,285	38	3	0	35	77,370	17	393
Indiana	47	15	1	31	77,104	13	1	1	11	17,208	35	58
Kansas	441	214	29	198	1,511,985	85	11	4	70	310,708	78	400
Kentucky	124	63	0	61	,160,734	28	4	0	24	37,260	97	232
East	0	0	0	0	0	0	0	0	0	0	0	75
West	124	63	0	61	160,734	28	4	0	24	37,260	97	157
Louisiana	290	183	20	87	2,322,542	51	16	3	32	517,419	0	441
North	95	66	9	20	361,031	11	3	0	8	60,513	0	132
South	153	90	8	55	1,592,117	36	12	2	22	410,467	0	250
Offshore	42	27	3	12	369,394	4	1	1	2	46,439	0	59
Michigan	37	15	1	21	112,281	14	2	0	12	38,282	29	97
Mississippi	25	11	0	14	183,049	9	0	0	9	73,619	0	34
Missouri	16	4	0	12	8,402	16	4	0	12	8,402	16	0
Montana	30	16	2	12	160,815	11	3	0	8	66,435	4	43
Nebraska	77	29	0	48	424,570	41	6	0	35	218,004	0	79
East	0	0	0	0	0	0	0	0	0	0	0	12
West	77	29	0	48	424,570	41	6	0	35	218,004	0	67
New Mexico	134	66	44	24	671,739	15	1	2	12	99,221	12	166
Northwest	46	0	36	10	176,004	9	0	2	7	47,469	2	42
Southeast	88	66	8	14	495,735	6	1	0	5	51,752	10	124
New York	26	11	0	15	41,647	2	0	0	2	6,607	24	8
North Dakota	20	12	0	8	158,458	6	2	0	4	38,594	0	25
Ohio	81	43	8	30	200,178	1	0	1	0	2,858	88	202
Oklahoma	696	427	17	252	2,357,542	72	12	2	58	307,473	125	1,021
Oregon	1	0	0	1	12,800	1	0	0	1	12,800	0	0
Pennsylvania	41	11	15	15	89,336	0	0	0	0	0	39	53
South Dakota	1	0	0	1	9,365	1	0	0	1	9,365	0	0
Texas	1,763	1,054	67	642	7,609,769	491	72	17	402	2,381,301	59	1,412
North (9)	326	169	4	153	1,044,794	85	13	0	72	355,113	14	184
West Central (7-B)	261	129	1	131	886,572	95	14	0	81	322,676	8	179
West (7-C & 8)	534	424	5	105	2,614,541	97	19	1	77	559,502	26	585
Panhandle (10)	93	66	14	13	346,122	11	4	1	6	73,462	0	78
East (5 & 6)	114	44	9	61	523,756	41	0	1	40	187,395	0	105
Southwest (1)	124	68	2	54	370,129	46	4	1	41	143,655	5	36
Gulf Coast (2)	67	31	9	27	411,513	26	4	3	19	157,764	0	23
Gulf Coast (3)	128	71	12	45	813,512	39	7	5	27	303,040	0	130
Southwest (4)	116	52	11	53	598,830	51	7	5	39	278,694	6	92
Utah	10	1	0	9	42,906	9	1	0	8	40,440	0	23
Washington	2	0	0	2	16,938	2	0	0	2	16,938	0	0
West Virginia	75	4	59	12	180,734	1	0	0	1	5,180	73	207
Wyoming	60	31	5	24	321,674	18	1	1	16	112,728	6	68
Total February 1956	4,615	†2,533	281	*1,801	18,974,714	1,030	‡149	31	850	4,909,483	721	§5,397
Total January 1956	4,955	2,643	345	1,967	20,491,616	1,148	158	35	955	5,585,937	618	5,481
Cumulative 1956	9,570	5,176	626	3,768	39,465,320	2,178	307	66	1,805	10,495,420	1,339	
Western Canada	199	156	6	37	951,987	40	6	5	29	189,826		
Alberta	134	110	6	18	712,655	21	4	5	12	114,820		
Saskatchewan	44	28	0	16	187,715	15	0	0	15	62,332		
Manitoba	20	18	0	2	47,665	3	2	0	1	8,722		
British Columbia	1	0	0	1	3,952	1	0	0	1	3,952		
January 1956	211	166	7	38	1,036,134	47	13	4	30	252,480		
Cumulative 1956	410	322	13	75	1,988,121	87	19	9	59	442,306		

*Incl. 82 service wells: Ill. 2, Kans. 6, N. Y. 13, Ohio 1, Okla. 50, Pa. 8, Tex. (Dist. 3) 2. †Incl. 69 cond. wells: S. La. 25, La. offshore 2, Miss. 1, Okla. 23, E. Tex. 7, Dist. (2) 4, Dist. (3) 4, Dist. (4) 3. ‡Incl. 11 cond. disc.: S. La. 2, Okla. 2, Tex. Panhandle 3, Dist. (2) 1, Dist. (3) 3. §Incl. Nev. 5.

per day from the Paradox-Pennsylvanian. This is the best gage yet reported in Paradox basin exploration.

The new Paradox producer is located 12 miles northeast of Desert Creek field. At month's end five other wells were announced for the immediate area.

Other Rockies events . . . Two discoveries in Montana and Colorado highlighted other exploratory events in the Rocky Mountain province.

Murphy Corp. established a new producing sand in the Williston basin, the Kibbey sand (a lower member of the Big Snowy group of Mississippian age). His 63 East Poplar Unit in Roosevelt County, Montana, flowed 63 bbl. of oil per day from the Kibbey. Only other Kibbey production in the Rockies is at Ragged Point field in Musselshell County, Montana.

. . . North Douglas Creek. Phillips Petroleum Co. uncovered another Weber-Pennsylvanian sand oil pool in northwestern Colorado at 1 Douglas "A," Rio Blanco County. The well swabbed 104 bbl. of oil in 10 hours on one test in the Weber. Location is 15 miles northeast of Hell's Hole Canyon. This is the second Weber discovery of note in this area in the past few months, the other being at the Thornburg Unit, Moffat County.

West Texas . . . Upton County received a prolific Ellenburger discovery. Texas Pacific Coal & Oil Co. 1 Jacobs, 11½

Total Depth Classifications, February 1956

	A 0-1,250 ft.	B 1,250-2,500 ft.	C 2,500-3,750 ft.	D 3,750-5,000 ft.	E 5,000-7,500 ft.	F 7,500-10,000 ft.	G 10,000-12,500 ft.	H 12,500-15,000 ft.	I Over 15,000 ft.
Alabama	0	0	1	1	0	0	2	0	0
Arkansas	0	15	19	11	3	0	0	0	0
California	20	39	32	36	34	27	9	2	0
Colorado	2	1	2	17	75	3	0	0	0
Florida	0	0	0	1	2	0	0	0	0
Georgia	0	0	0	1	0	0	0	0	0
Idaho	0	0	1	0	0	0	0	0	0
Illinois	25	90	146	1	0	0	0	0	0
Indiana	17	22	8	0	0	0	0	0	0
Kansas	0	79	183	165	14	0	0	0	0
Kentucky	81	40	2	0	0	1	0	0	0
East	0	0	0	0	0	0	0	0	0
West	81	40	2	0	0	1	0	0	0
Louisiana	4	53	12	10	40	59	64	43	5
North	3	48	8	6	15	14	1	0	0
South	1	3	4	4	13	30	53	40	5
Offshore	0	2	0	0	12	15	10	3	0
Michigan	3	11	11	9	3	0	0	0	0
Mississippi	0	0	1	2	14	3	3	2	0
Missouri	15	1	0	0	0	0	0	0	0
Montana	0	5	7	4	5	9	0	0	0
Nebraska	0	0	4	16	56	1	0	0	0
East	0	0	0	0	0	0	0	0	0
West	0	0	4	16	56	1	0	0	0
New Mexico	2	25	35	28	23	6	8	7	0
Northwest	1	20	7	2	14	2	0	0	0
Southeast	1	5	28	26	9	4	8	7	0
New York	0	24	2	0	0	0	0	0	0
North Dakota	0	0	0	0	5	15	0	0	0
Ohio	16	12	49	4	0	0	0	0	0
Oklahoma	117	184	161	66	81	76	10	1	0
Oregon	0	0	0	0	0	0	0	1	0
Pennsylvania	0	31	9	0	1	0	0	0	0
South Dakota	0	0	0	0	0	1	0	0	0
Texas	126	368	354	338	357	151	47	22	0
North (9)	54	102	36	61	63	9	1	0	0
West Central (7-B)	15	90	44	61	51	0	0	0	0
West (7-C & 8)	8	69	147	127	101	47	16	19	0
Panhandle (10)	1	5	73	1	4	8	1	0	0
East (5 & 6)	10	25	6	19	46	6	1	1	0
Southwest (1)	21	43	16	31	10	0	2	1	0
Gulf Coast (2)	0	1	7	17	19	22	1	0	0
Gulf Coast (3)	8	17	9	10	24	41	19	0	0
Southwest (4)	9	16	16	11	39	18	6	1	0
Utah	1	0	5	1	1	2	0	0	0
Washington	0	0	0	0	1	1	0	0	0
West Virginia	3	44	20	7	1	0	0	0	0
Wyoming	2	8	5	11	24	7	3	0	0
Total February 1956	434	1,052	1,069	729	740	362	146	78	5
Total January 1956	497	1,136	1,188	734	742	411	169	68	10
Cumulative 1956	931	2,188	2,257	1,463	1,482	773	315	146	15
Western Canada	0	16	27	54	92	10	0	0	0
Alberta	0	1	9	24	91	9	0	0	0
Saskatchewan	0	1	12	29	1	1	0	0	0
Manitoba	0	14	6	0	0	0	0	0	0
British Columbia	0	0	0	1	0	0	0	0	0
Cumulative 1956	0	40	46	115	184	25	0	0	0

miles north of McCamey and 3 miles west of King Mountain. Ellenburger field, was completed flowing 1,368 bbl. of oil per day. Four offsets were immediately staked to the new strike.

Hugoton Embayment . . . Humble Oil & Refining Co. opened first production in Lipscomb County in the far northeastern corner of the Texas Panhandle. The 1 Merydith flowed 1,110 M.c.f. of gas per day and 29 bbl. of condensate from Morrow sand at 10,162-10,205 ft. Nearest production is 10 miles southwest in Ochiltree County.

Southwest Texas . . . The Edwards lime, principal objective in spreading deep exploration along the southwest end of the Balcones fault trend through LaSalle and McMullen counties, proved productive at Stanolind 1 Cooke, 15 miles northeast of Stuart City in southwestern LaSalle County. The dry gas flow was 8,500 M.c.f. daily.

Louisiana Offshore . . . The C.A.T.C. group with Continental Oil Co. as operator opened another field offshore from Cameron Parish. The new pool discovery is in Block 62, East Cameron area, 15 miles from shore. The well flowed gas from two Miocene sands.

Southeastern States . . . Alabama's Citronelle field was extended 2 miles south at Trans-Tex Drilling Co.'s well, 2½ miles south and on the opposite side of Citronelle town. Production is from Lower Cretaceous-Rodessa.

Activity was revived in Mississippi's Black Warrior basin at Pure Oil Co. 1 Murphree, northwestern Monroe County. The well flowed 3,000 M.c.f. of gas per day from the Carter sand (Mississippian-Chester).

Depth record falls . . . Oklahoma's producing-depth record of 14,510 ft. was broken at British American Oil Producing Co. 2 Harrison in shallow Knox field, Grady County.

The discovery flowed 30-40 bbl. of distillate an hour and 5,500 M.c.f. of gas per day on tests from 15,250 to 15,310 ft. in Ordovician Bromide sands.

Tennessee's '55 Score: 31 Tests, 41,000 Ft. of Exploration

. . . Second deepest test goes to 5,405 ft.

by H. C. Milhous

THIRTY-ONE test wells were completed in 1955 with a total exploratory footage of more than 41,000 ft. Three of these were small oil wells and one with a good gas show had not been thoroughly tested at the end of the year. Eight tests reached the Knox dolomite and a 5,405-ft. hole in Cumberland County was the second deepest ever drilled in Tennessee. Interest and activity at the end of the year indicate considerable exploration during 1956.

Development

With the exception of one test in Decatur County, all exploration was in the Middle Tennessee province with a concentration of tests in the northern Cumberland Plateau. Only two in the plateau area had been completed at the end of December, and five other deep tests were still drilling or temporarily shut down.

Memphis Equipment Co. 1 Cordle in Decatur County penetrated more of the Knox dolomite than any of the other seven tests which reached it. It had a total depth of 4,800 ft. and encountered Knox at about 925 ft. Good oil shows were found at several horizons in the Knox.

Shell Oil Co. 1 Peterson in Cumberland County had a total depth of 5,405 ft. and reached the Knox at 4,985 ft. No shows were reported in the Knox.

Sun Oil Co. 1 Clemmer-Robertson in Bledsoe County cut only 267 ft. of Knox. It had a small gas show at 3,145 ft. and a total depth of 3,380 ft.

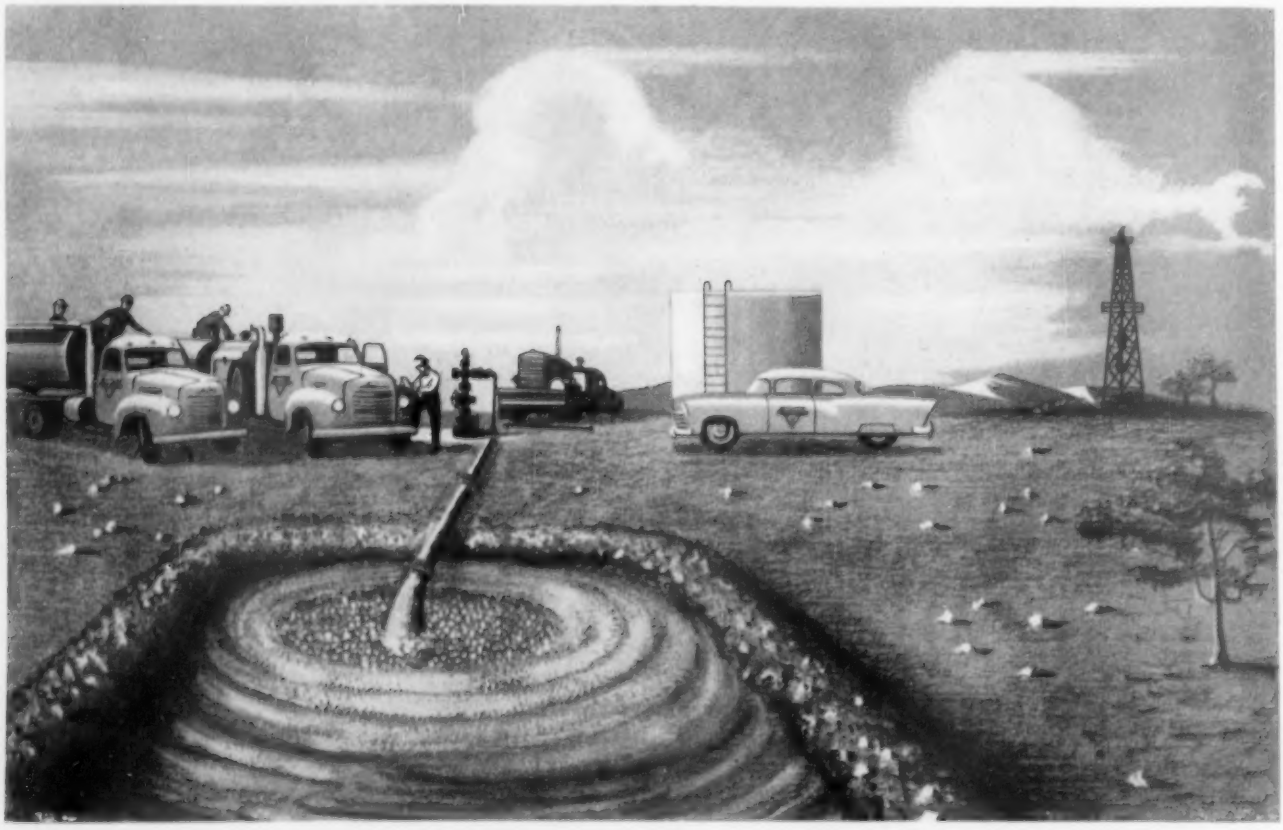
Nelson Oil & Gas Co. 1 Boos in Anderson County had a good gas show in the Chattanooga shale at 3,311-23 ft. It did not appear to be greatly improved by shooting, and results of tests had not been released at the end of the year.

Three small oil wells in northern Clay County had pays in the lower Trenton and upper Stones River, ranging in depth from approximately 400 to 800 ft. below the surface. Production is estimated at 5 to 10 bbl. per day each at the end of December. The following deep tests were still drilling or temporarily shut down at the close of 1955: Anderson County—Columbian Carbon Co. 1 Tennessee Mining & Manufacturing Co. and W. W. Mausch 1 Coal Creek Mining & Manufacturing Co.; Campbell County—Columbian Carbon Co. 1 East Tennessee Iron & Coal Co. and W. F. Lacy 1 Lindsey Land Co.; Morgan County—Ben Tate et al. 1 Baker-Pemberton.

Oil Production

Total oil production for 1955 was 12,747 bbl. Production by counties was as follows: Clay—3,122 bbl., Fentress—

The author is senior geologist, Tennessee Division of Geology.



Shown on the map are the important wildcats drilled in Tennessee in 1955. 1. Memphis Equipment Co. 1 Cordle; 2. Overby et al. 1 Overby; 3. Peterson et al. 1 Womack; 4. Adams et al. 1 Cowan; 5. Callicott & Smith 1 Grace; 6. Harris 1 Reiser; 7. Sun Oil Co. 1 Clemmer-Robertson; 8. Claud Hamill et al. 1 Huff; 9. Little Wabash Oil Co. 1 Pyle; 10. Shell Oil Co. 1 Peterson; 11. Nelson Oil & Gas Co. 1 Boos.

414 bbl., Morgan-Scott—7,895 bbl., Pickett—804 bbl., and Robertson—512 bbl.

Gas Production

Total gas production was approximately 40 M.M.c.f. Scott-Morgan County field produced 31,396,000 cu. ft., Jamestown field in Fentress County about 8 million, and the production from the Greenup-David well at Briceville in Anderson County is estimated at 1 million.

Acknowledgment

Thanks are hereby expressed for the assistance of W. D. Hardeman, state geologist of Tennessee; T. R. Pierce, senior geologist, Tennessee Division of Geology, and for the cooperation of the drillers, operators, and refiners who furnished valuable information.

IMPORTANT WILDCATS DRILLED IN 1955

Map No.	Operator, location and county—	Total depth	Surface formation	Deepest zone tested	Remarks
1	Memphis Equipment Co., 15-13s-17e, Decatur	4,800	Cre., U.	Ozarkian	D & A
2	Overby et al., 9-10s-24e, Hickman	1,269	Miss., L.	Knox, U.	D & A
3	Peterson et al., 17-1s-38e, Sumner	1,300	Ord., M.	Knox, U.	D & A
4	Adams et al., 7-A 45e, Macon	2,095	Miss., L.	Knox, U.	D & A
5	Callicott & Smith, 23-B 48e, Clay	900±	Miss., L.	Ord., L.	D & A
6	Harris, 23-B 48e, Clay	800±	Miss., L.	Ord., L.	Oil
7	Sun Oil Co., 22-9s-52e, Bledsoe	3,380	Penn., L.	Knox, U.	D & A
8	Claud Hammill et al., 14-A 54e, Pickett	1,828	Miss., L.	Knox, U.	D & A
9	Little Wabash Oil Co., 25-B 55e, Pickett	1,700	Miss., L.	Knox, U.	D & A
10	Shell Oil Co., 2-8s-56e, Cumberland	5,405	Penn., L.	Knox, U.	D & A
11	Nelson Oil & Gas Co., 4-5s-64e, Anderson	3,404	Penn., L.	Sil.?	Gas*

*May be commercial.

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Mud-Sol TREATING ACID

for removing mud . . . to clean up your well
to make a better completion

A recurring problem in removing drilling mud from oil and gas producing formations by chemical means is caused by the complex chemical make-up of the drilling mud itself. Adding to the problem is the presence of the surrounding formation and drill cuttings in the mud.

Mud-Sol is a solvent developed by The Chemical Process Company laboratory which is so well-balanced that it cleans mud from limestone, sandstone, and dolomitic formations with equal effectiveness. At the same time, buffer chemicals in the solvent prevent the formation of pore-plugging, gelatinous compounds and emulsions. Other chemicals in the formula insure that undissolved solids will remain dispersed and suspended until the treatment residue is removed from the formation.

Mud-Sol has no equal on the market to:

- Remove a mud block
- Clean up a well prior to conventional acidizing or hydraulic fracturing treatments
- Clean up a well prior to casing cementing or squeeze-cementing operations, or to spearhead a squeeze-cementing job
- Clean up a well to increase production

Mud-Sol is an important part — but ONLY a part — of our complete well stimulation service. The superior qualities of this service are based on 24 years of experience — all of which become yours the minute you call a Chemical Process Company service station.

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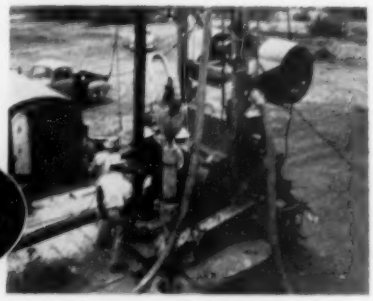
Drilling Contractors, Olney, Texas
Report on Their

WICHTEX
PORTABLE ROTARY RIG
Model R-4



"We have drilled over 300 holes with our Wichtex R-4, and are convinced that this is the most profitable rig we could own. Our records show the following:

LOW MAINTENANCE

"Our only parts replacements have been one set of brake bands, one drum sprocket, one set of rotary belts, and chains. We have never replaced a clutch or any other part.

FAST MOVES

"The R-4 is one compact unit, wheel mounted, that moves and sets up without assembly or disassembly. We can tear down, move 30 miles, and be drilling, all within 7 hours!

FAST DRILLING

"Following are a few reports taken at random from our job records:

Drilled 2300′ in 7 days—Jack County, Texas
Drilled 1682′ in 4 days—Knox County, Texas
Drilled 713′ in 1 day—Young County Txeas
Drilled 2895′ in 8 days—Jack County, Texas
Drilled 868′ in 2 days—Young County, Texas
Drilled 3093′ in 17 days—Young County, Texas

WICHTEX Rotary Rigs handle more jobs per month, at less cost! They are available with telescoping or "A-type" mast, wheel or skid mount, in a choice of 4 sizes with capacities from 2000′ to 5000′. Write for details.

WICHTEX MACHINERY COMPANY INC.

BURKBURNETT ROAD — WICHITA FALLS, TEXAS

EXPLORATION HIGHLIGHTS

WESTERN CANADA

Slight Increase Noted In Geophysical Activity

February geophysical activity in Western Canada climbed slightly over the previous month. There were 155 crews active in the western provinces.

Alberta . . . This province accounted for 104 seismograph crews and 4 gravitymeters.

British Columbia . . . The highest number of crews ever to work this province, 31, included 30 seismic units and one gravitymeter. Eleven separate operators back these crews. Imperial Oil, Ltd., led the British Columbia area with nine seismic crews, one gravitymeter.

Saskatchewan . . . Activity dropped in Saskatchewan with only 11 seismic crews at work.

Manitoba . . . Only two parties were active in this province. There were three active seismic crews in the Northwest Territories.

According to the Daily Oil Bulletin the Texaco Exploration Co. with 14 seismic crews in operation in Alberta led the field of operators active in one province. Imperial is next with 11 crews active in Alberta, two in Saskatchewan, and 10 in British Columbia. Canadian Gulf Oil Co. has 10 seismograph crews working Alberta and 1 gravitymeter outfit. The company also has three seismographs in operation in Saskatchewan. Stanolind Oil & Gas Co. has 10 crews working in Alberta and 3 in British Columbia.

The Bulletin says that two contractors each are working 13 crews and another reports 11 parties in the field. Geophyhical Services International, Inc., with 11 seismic and 2 gravityme-

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ter leads the field. Western Geophysical Co., Canada, has 13 seismic outfits active. United Geophysical Co. of Canada reports 11 seismograph parties in action and also has 1 of the 5 Velocity Logging units in Western Canada. Century Geophysical Corp. of Canada and Seismograph Service Corp. have nine parties at work, all seismic. Seismograph Service Corp. has two Velocity Logging units in action, one out of Calgary, the other out of Grande Prairie in Alberta. Shell Oil Co. and Mobil Oil Co. of Canada, Ltd., have two Velocity Logging units at work out of Calgary.

S.E.G. Scholarship Program Announced by Dunlap

The scholarship program of the Society of Exploration Geophysicists was inaugurated with the announcement by S.E.G. President R. C. Dunlap, Jr., of Mayhew Scholarship in Geophysics. Funds for the award will be granted by Charles M. Mayhew, seismic field equipment manufacturer of Dallas, Texas. The award of $3,000, providing $750 per year for 4 years toward tuition and other expenses, will be made annually to the son or daughter of a person engaged in geophysical work and employed by a geophysical company, geophysical branch of an oil company, or a contract drilling company, Dunlap said, and only high school seniors or graduates will be eligible. A committee to be appointed by Dunlap will select this year's recipient. Applications may be obtained from the S.E.G. headquarters in Tulsa, Okla., or from the presidents of the local sections.

In announcing the scholarship program Dunlap spoke of the urgent need for trained geophysicists, engineers and other scientists to maintain the technology of the world. He said the S.E.G. program is part of the society's continued efforts to interest young people in scientific and engineering careers, especially in exploration geophysics.

"We hope this initial grant by Mayhew will encourage others in the geophysical industry to join our society in promoting the science of geophysics through scholarships and fellowships," Dunlap said.

APPALACHIAN

WEST VIRGINIA

In Clover district, Tucker County, West Virginia, Hope Natural Gas Co. 9967 Walter Hovatter, wildcat, elevation 2,016 ft., had a final gage of 2,236,000 cu. ft. of gas after shot, chert 4,955 ft., Oriskany sand 5,120 ft., gas 5,222-28 ft. Total depth 5,235 ft.

● Fork Lick district, Webster County, Bolair Gas Co. 1 E. M. Morton, was dry and completed at 1,884 ft.

● In Glade district, this company has abandoned its 1 Robert Miller, location.

In Gore district, Hampshire County, West Virginia, Columbian Carbon Co. has started operations in 1-1228 Lonza Kidwell et al, rank wildcat, elevation 953 ft. It is on the Hanging Rock Quadrangle 3.68 miles south of latitude 39 degrees 30 minutes and 3.18 miles west of longitude 78 degrees 30 minutes.

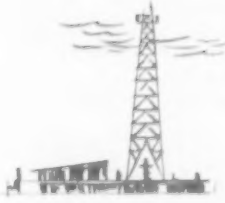
● In Sherman district, M. E. Anderson 1 J. E. & B. Orndorff, deep test, is drilling at 7,318 ft.

● Dry Fork district, Randolph County, Nelson W. Taylor, Agt., 1 H. R. Tingler is at 3,029 ft.

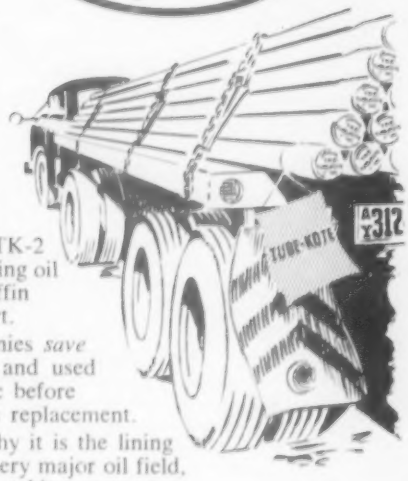
OHIO

Natol and Shuff and Bucy completed a small well on 3 Mizer, Section 22, Perry Township, Coschocton County, to extend the pool at West Carlisle ¼ mile to the east. Clinton sand at 3,280-

NOW...
15,000,000
feet of TK-2 coated tubing are in use!



TUBE-KOTE



15,000,000 feet in use . . . twice as much as in 1954 . . . proof of TK-2 dependability in preventing oil field corrosion and paraffin troubles before they start.

Result: more oil companies *save* money by coating new and used tubing with TK-2 plastic before corrosion damage forces replacement.

Learn about TK-2 — why it is the lining companies specify for every major oil field, how it makes your first tubing cost your last, even in the most corrosive field. Write for new TK-2 literature.

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PIONEERS IN PLASTICS SINCE 1939

Manufacturers-Extruders of Plastic Pipe for the Oil Industry . . . Factory-trained Field Engineers available for Consultation in all Principal Oil Areas.

3,340 ft. gaged 45 bbl. after fracture treatment.

● At Brinkhaven in Union Township, Knox County, Lot 24, Guy Horn 7 fee, on an outside location, made 70 bbl. and gaged 350,000 cu. ft. gas from fractured Clinton at 2,771-2,818 ft.

In Hopewell Township, Muskingum County, the Preston Oil 4 Varner, Section 4, made 165 bbl. in a 24-hour test from Clinton at 3,321-70 ft. The completion is the farthest east producer in Cottage Hill pool.

Natol Corp.'s first attempt to develop production in the north central part of Granger Township, Medina County, resulted in a 200-bbl. well with 350,000 cu. ft. gas on 1 Fred Sylvester, Lot 43. Red Clinton at 3,400-50 ft. had a fair showing before fracturing.

● Central Ohio Oil & Gas Co.'s second test in Hopewell Township, its 2 Thos. Esselstein, Lot 36, in Muskingum, made 300 bbl. in a 9-hour test after fracturing Clinton, found at 3,126-65 ft.

● Another good well was completed along the southeast edge of Flint Ridge field in Hopewell Township, Licking County. The L. L. Dittoe et al 1 (2) G. H. Tavenner, Section 20, gaged 3 bbl. natural from Clinton at 3,199-3,233 ft. and 350 bbl. after fracturing.

EASTERN KENTUCKY

Ashland Oil & Refining Co. has added another producer to the Oil Springs pool in Eastern Magoffin County. No. 73 Gardner Blanton pumped initially at the rate of 11 bbl. of oil daily from a total depth of 1,140 ft. in the Weir (Mississippian) sandstone.

A good well for the Pike County sector of Big Sandy gas field has been completed. W. E. Burchett's 2 Earl D. Bonzo initialed at the rate of 14,276,000 cu. ft. of gas daily from Mississippian Big lime at a total depth of 2,344 ft. A 24-hour rock pressure test showed 355 lb. Well was located on Hatfield Branch.

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NEW No. 5 JENSEN JACK

with double and single gear reductions.

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Before you buy any jack, get complete information about the functional design, economy and dependability of the NEW No. 5 JENSEN JACK. See your dealer or write JENSEN BROS., manufacturers of JENSEN JACKS for more than 36 years.

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HUGOTON EMBAYMENT

OKLAHOMA PANHANDLE

Widespread Success Enhances Beaver's Promise

Orville H. Parker 1 Sleeper-A, C NW SE 26-2n-23eCM, Beaver County, the west offset to a recent Morrow gas discovery in a Thirteen Finger lime area, is an indicated Morrow oil strike.

The well recovered 480 ft. of oil, 90 ft. heavily oil-cut mud and 90 ft. slightly oil-cut mud on a drill-stem test at 7,588-7,630 ft.

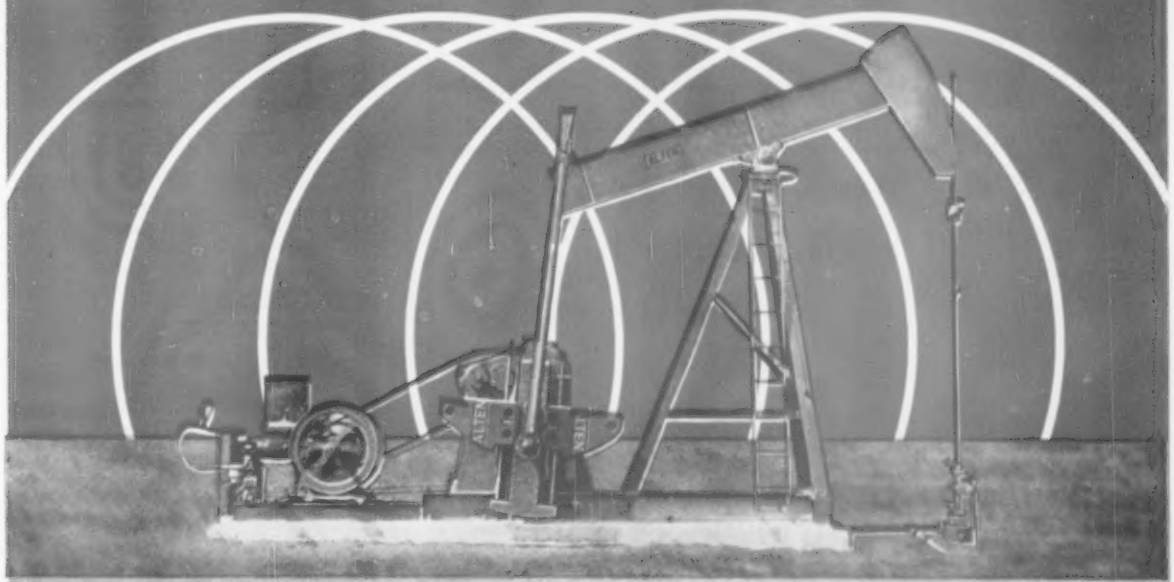
West Timber Creek . . . United Producing Co. added the second gas well to a new area east of West Timber Creek-Marmaton oil field. The 2 Mayo, C NW SE 7-4n-25eCM, flowed 2,250 M.c.f. of gas per day, natural, through perforations at 6,782-6,806 ft. in the Chester-Mississippian. After acidization the well made 9,800 M.c.f. per day.

East Camrick . . . This Beaver County area has been extended again. Magnolia Petroleum Co. 1 Williams, C NE NE 28-1n-20eCM, pumped 77 bbl. of

Four wells are keeping embayment eyes on Beaver County, Oklahoma Panhandle.

Pumping their way to Leadership

ALTEN Pumping Units



A FULL LINE OF 47 MODELS AND TYPES FROM 6000 IN. LBS. PEAK TORQUE TO 320,000 IN. LBS. A. P. I. — ALL

TOP QUALITY WITH THESE ADVANCED FEATURES

Screw type adjustable counterbalance with locking device and calibrations (one man may adjust with safety while standing on the ground). . . . Forged steel gears---Helical or herringbone gear reducers. . . . Saddle provides four-way walking beam adjustment. . . . Bronze bushed long life saddle bearing. . . . Self aligning roller wrist pin bearings. . . . Tapered wrist pin cannot rotate in crank. . . . Internal expanding automotive type brake of ample capacity. . . . Over-the-beam equalizer. . . . Rugged, samson post and frame. . . . Adjustable horsehead may be swung back over the beam for well servicing.

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Foundry & Machine Works, Inc.
LANCASTER, OHIO

WORLDWIDE DISTRIBUTION THROUGH SUPPLY STORES

oil in 16 hours from Morrow sand perforations at 7,310-18 ft.

Northeast Greenough . . . This Morrow gas field has moved east. The extension success is Trice Production Co. 1 Hunter, C SE NW 23-6n-22eCM. The Morrow well gaged 5,727 M.c.f. per day on a drill-stem test at 6,276-6,300 ft.

SOUTHWEST KANSAS

New Morrow Discovery Completed in Meade

Meade County has a new Morrow sand discovery. Gulf Oil Corp. 1 Edna

Producing area description of Nye-Morrow sand gas pool, Beaver County, Oklahoma.

Collinwood, C NW SW 1-33s-30w, 4 miles south of Plains and 1 mile east of Leslie field, flowed 4,000 M.c.f. of gas per day plus 49 bbl. of oil from perforations at 5,733-48 ft.

RIDGEWAY HEEBNER
GAS POOL
WHITE EAGLE OIL CO I BENNETT
SW NE 2-3N-25 E CM BEAVER COUNTY
COMPLETED SEPTEMBER 28, 1955
PRODUCING AREA DESCRIPTION
T 3 N-R 25 E CM: SEC 2-SW¼NE¼
NW¼SE¼NE¼SW¼SE¼NW¼

Producing area description of Ridgeway-Heebner gas pool, Beaver County, Oklahoma.

MID-CONTINENT

KANSAS

Pennsylvanian Strike At Trego County Wildcat

Trego County has a new Toronto discovery prospect at Imperial Oil of Kansas 1 Newcomber, NE NE SW 12-12s-23w, 4 miles northwest of Ogallah pool and 2½ miles east of Wakeeney.

Recovery on a test of the Toronto lime at 3,621-41 ft. was 120 ft. heavily oil-cut mud. A test of the Lansing lime at 3,678-99 ft. recovered 1,450 ft. gas and 450 ft. oil. Another test at 3,732-45 ft. got 2,400 ft. clean oil. Recovery on a straddle test at 3,716-27 ft. was 1,020 ft. of oil. A similar test at 3,699-3,710 ft. got 2,100 ft. of oil. A test at 3,742-56 ft. got 1,800 ft. gas, 120 ft. oil-cut mud, and 240 ft. muddy oil.

Testing Due at New Harper County Discovery

Testing of the Simpson sand is due at J. M. Huber's 1 Denton-Fox, C SW NE 30-34s-6w, Harper County discovery 4½ miles south of Anthony gas pool in the southern part of the county.

A drill-stem test in the Simpson sand at 5,216-23 ft. recovered 3,600 ft. gassy oil and 300 ft. heavily oil and gas-cut mud.

OKLAHOMA

Cherokee Trend Well Completed in Eureka Area

Sunray Mid-Continent Oil Co. has completed the No. 2 Switser in Grant

Heavy Handling Job Made Easy with SAFE, Dependable BRADEN WINCHES

BRADEN WINCHES ARE:

★ **SAFE:** Up to 50% more reserve pulling and holding power than ratings indicate.

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County, as an oil producer in the Cherokee zone at 4,889 to 4,900 ft. The well is an extension of Eureka field and is located at SE¼, 8-28n-8w.

The well flowed at the rate of 794 bbl. of oil a day through an 18/64-in. choke with 480 psi. Total depth was 4,960 ft. but the hole was plugged back to 4,925 ft. and acidized with 500 gal. of acid and Fraced with 10,000 gal. of oil and 15,000 lb. of sand. Gas volume was 555,800 cu. ft. a day and the gas-oil ratio was 700:1.

WEST TEXAS-NEW MEXICO

SOUTHEAST NEW MEXICO

Devonian Oil Flow at South Denton Outpost

Signal Oil & Gas Co. was assured of confirmation Devonian production at its new South Denton pool in east-central Lea County, 12 miles east of Lovington.

Signal 1 Tekell-State, a ½-mile southwest stepout in 5-16s-38e, flowed 67.17 bbl. of 46° oil in 1 hour through ¾-in. choke on a drill-stem test of the Devonian at 13,110-70 ft. Gas-oil ratio was 637:1. On ¼-in. choke the well flowed 14.68 bbl. of oil in 46 minutes. Flowing pressures were not reported.

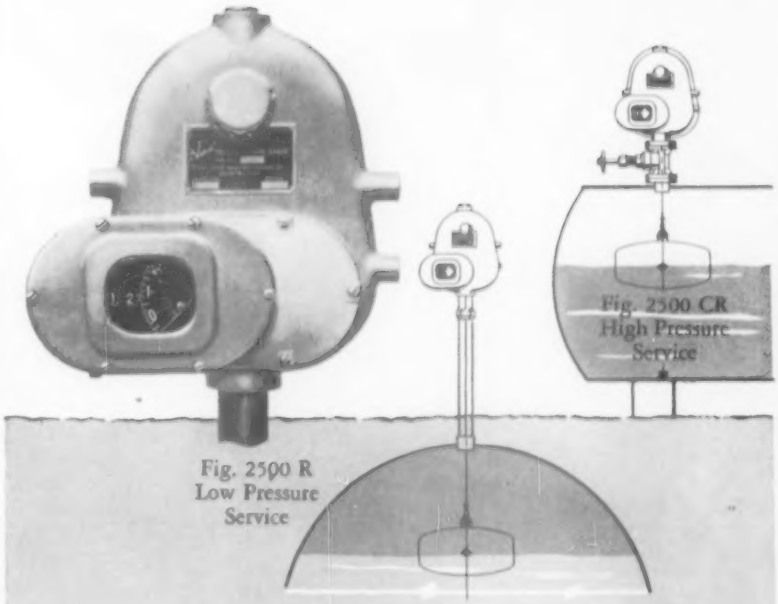
A subsequent test at 13,170-13,220 ft. recovered 5,972 ft. of oil but did not flow. At 13,229-95 ft. recovery was 620 ft. of oil, and on a 4-hour test at 13,300-70 ft., gas surfaced in 1 hour and 30 minutes but recovery in the pipe was water blanket and sulfur water. Operators were running electrical logs.

Signal 1 Kelly-State, a northwest stepout was drilling below 11,950 ft. at last report. It was said to be running approximately 135 ft. higher on the

South Denton pool was in line for a second producer, and southwest extension at Signal Oil & Gas Co. 1 Tekell. Signal 1 Kelly had not reached the Devonian at this writing but was checking high on the Mississippian. Signal opened South Denton to Devonian production in November 1955.

NEW! TOP READING AUTOMATIC TANK GAUGE

"Varec" FIG. 2500 R SERIES



Introducing a special adaption of the Figure No. 2500 series, designed for use on all tanks, below or above ground, where top readings are required.

Elbow sheaves and brackets are eliminated on this model. The stainless steel tape is connected from the gauge head to float in a straight line. Elimination of extra parts reduces friction; therefore, greater accuracy can be expected.

Figure No. 2500 R is float and Neg'ator motor actuated, has the combination counter and dial reading, gravity compensator, and built-in operation checker. Can be mounted directly on tank or at eye level at customer's option. Furnished for working pressures to 2.5 p.s.i.g. as standard.

For higher working pressures to 300 p.s.i.g., the Figure No. 2500 CR is recommended. Its counter mechanism is magnetic driven, no packing glands or mechanical seals required on the rotating shaft. Convenient provision is made for mounting remote gauger transmitters, and high or low level limit switches for sounding alarms, lighting lights, starting and stopping pumps, etc.

Contact your "Varec" representative or write the factory for full information.

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MODEL NO.	OLD H.P.	NEW H.P.	APPROX. INCREASE
Super PTD-6	280	364	30%
Super PTD-8	375	485	29%
Super PTDS-6	460	560	22%
Super PTDS-8	620	750	21%

* Maintaining Superior's conservative rating, including fan and all other accessories. Continuous, at 900 RPM. No correction necessary to 1500 feet elevation and 90°F.

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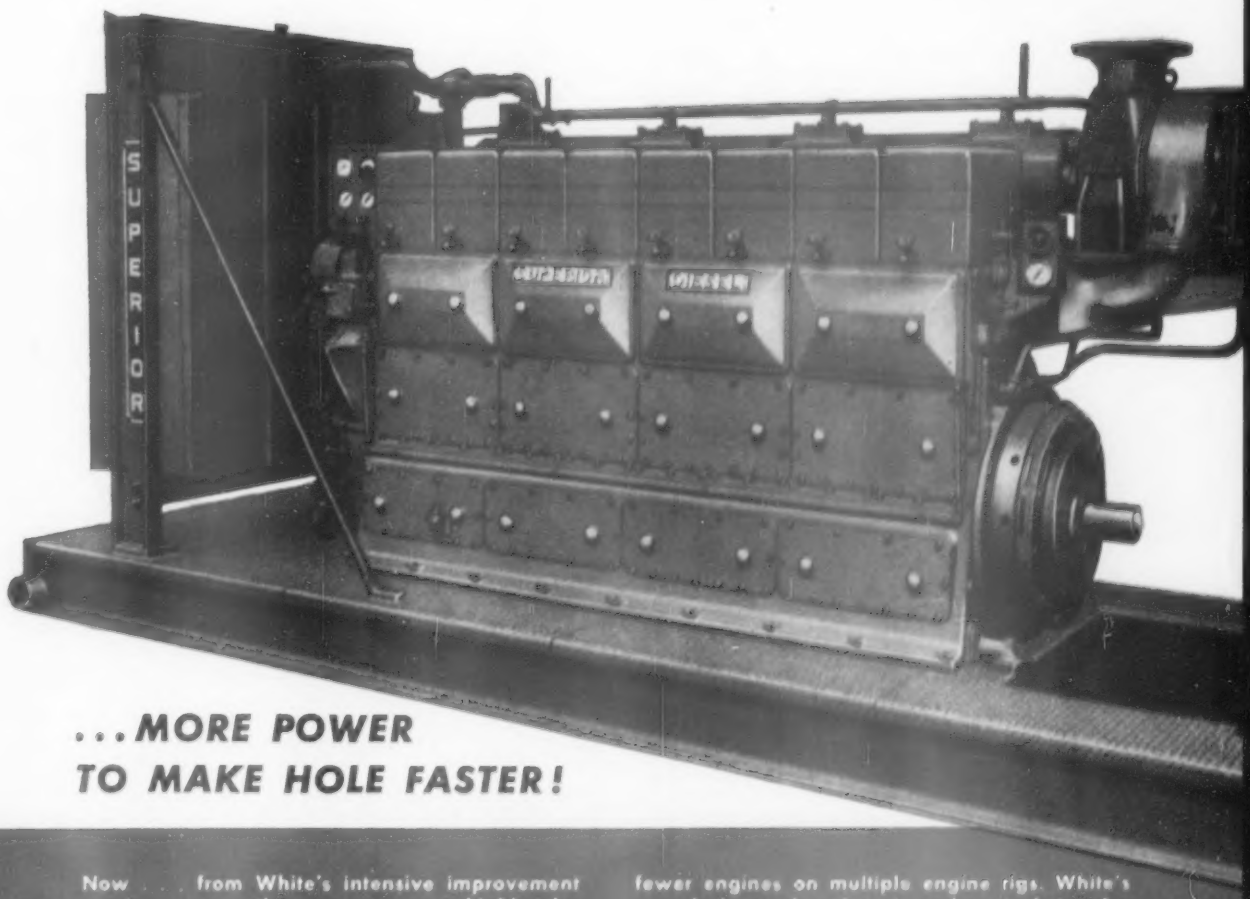


...MORE POWER TO MAKE HOLE FASTER!

Now . . . from White's intensive improvement program come the newest, most highly developed Superior Diesel heavy duty drilling engines with up to 30% more power, and virtually no increase in size . . . resulting in less weight and less cost per horsepower! They give you greater working ability than ever before . . . more lugging power for easier hoisting, and faster acceleration for quicker round trips. They'll "loaf" along with plenty reserve power for emergencies. This also means you can get more power from fewer engines on multiple engine rigs. White's new design and engineering advances have also achieved even greater dependability, smoother operation, increased engine life, lower operating and maintenance costs, and highly improved engine efficiency.

All the new features of the Super PTD (naturally aspirated) and Super PTDS (supercharged) engines are described in Bulletin 105 . . . available now at supply stores of leading rig manufacturers, or write to the Springfield office.

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY *Plant and General Offices: Springfield, Ohio*

Superior ENGINES ATLAS White DIESEL

Upper Mississippian marker than the discovery well. Top of the formation was not disclosed, but top of the Upper Mississippian in Signal 1 Gulf-State, opener of South Denton pool, was logged at 11,600 ft. on elevation of 3,760 ft.

Wolfcamp Extension Is Completed

Atlantic Refining Co. 1 Price, 31-15s-35e, north of Townsend field, has been completed as a Wolfcamp discovery, or extension well to Townsend production. Calculated daily potential was 201.6 bbl. of oil, based on a 16-hour flow of 135 bbl. through 18/64-in. choke. Perforations in the Wolfcamp were at 10,492-10,552 ft.

Pipe Run for Completion

Cabot Carbon Co. was running casing for completion attempt in the Devonian at its 1 Fleet, multipay prospect southwest of the 1-well King-Wolfcamp pool.

Drill-stem test at 12,695-12,755 ft. recovered water blanket and 60 ft. of drilling mud with no shows. A 2-hour test from 12,741-12,839 ft. developed 2,520 ft. of sulfur water. Operator then ran logs for completion.

The well has indicated production from the Wolfcamp, Pennsylvanian and Mississippian. On tests in the Devonian it flowed 22 bbl. of oil in 1 hour at 12,380-12,502 ft., and recovered oil on tests at 12,313-80 and 12,586-12,676 ft.

WEST TEXAS

Montoya Formation Flows In Winkler County

Montoya pay on the southern flank of Halley field in southern Winkler County has been assured at Richardson Oils, Inc., 1-B Stanolind et al. The well was swabbed in after acid treatment through perforations at 10,350-10,400 ft. An early gage produced 19 bbl. of 41.8° oil an hour through ¼-in. choke. In an 18-hour test it tanked 334 bbl. of oil through the same size choke and perforations. Flowing tubing pressure was 1,800-1,850 psi., and gas-oil ratio was 2,515:1.

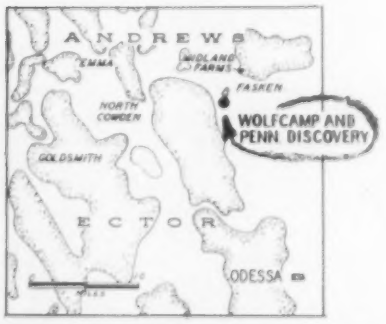
Location of the well is in Section 22, Block 11, PSL Survey, 8 miles northwest of Wink.

The well was drilled to 12,401 ft., in Ellenburger topped at 12,134 ft., then plugged back to 12,248 ft. There were oil shows logged also in the Glorieta, Devonian, Fusselman and the Ellenburger. Montoya is the upper Ordovician, and produces mostly in Southeastern New Mexico.

Northern Ector County Gets Dual Discovery

Stanolind Oil & Gas Co. has opened Pennsylvanian and Wolfcamp production at its 1 Midland Farms "AJ," 17 miles north and slightly west of Odessa. Location of the dual discovery is near the northern county line, and southwest of Grayburg (4,750-4,800 ft.) production in Fasken pool, Andrews County.

Operators reported top of Pennsylvanian pay at 10,158 ft. Completion potential from perforations at 10,158-86 ft. was 287 bbl. a day. Gravity was 39°.



Stanolind 1 AJ Midland Farms opened Wolfcamp and Pennsylvanian production in northern Ector County.

competition *makes it better!*

YES SIR, you checkmate yourself in a world of monopoly. We all need competition whether it be in games or in business. Competition makes the difference in oil well cementing service, too. We're proud that we *put* competition into the business and we plan to *keep it there.*

Engineered answers to oil well cementing

BJ SERVICE, INC.

Top of the Wolfcamp was 8,290 ft., and perforations were made from 8,290-8,300 ft. Potential was 364 bbl. of 34° oil a day.

The well was drilled to 13,228 ft., then plugged back to 10,186 ft. Stanolind owns full interest in the discovery, and holds about 2,240 acres surrounding it.

GULF COAST

SOUTH LOUISIANA

Gas-Condensate Production Uncovered in Milton Area

The Milton area, 10 miles north of Abbeville in northeastern Vermilion Parish, near the Lafayette Parish line, is being proved productive in a wildcat test drilled by Seaboard Oil Co.

The indicated discovery-well, 1 J. H. Hebert, Jr., flowed at the rate of 4,235,000 cu. ft. of gas and 96 bbl. of condensate per day while testing perforated intervals in Frio sand at 11,380-82 ft. and 11,388-92 ft. Flow was restricted to 5/32-in. choke. Pressure was 7,000 psi., flowing, and 7,300 psi., shut-in.

Shallower potentially productive sands were to be tested before completing the well. Total depth of the well is 13,060 ft.

Nearest production is Sunray Mid-Continent Oil Co. and associates' recently completed gas-condensate discovery well at Ridge, in Lafayette Parish, 5 miles northwest. It produces from Frio sand at 12,158-77 ft.

The Milton discovery well is Seaboard's second test in the immediate area. The first, 1 Picard, abandoned temporarily last April, was drilled to 13,176 ft. and has pipe cemented to 13,175 ft. It was reported to have

Milton area (indicated by arrow) on Vermilion-Lafayette parish line showing locations of Seaboard Oil Co.'s indicated gas-condensate discovery well (A) and its first test (B), to be reentered after being "temporarily abandoned" since April 1955.

$35,000,000 Oil Drilling Boom On—

Cuba's New Oil Rush Unfolds Discovery-Upsurge Profit Vistas in Selected Low-Priced Oil Stocks

FEW people yet know it but Cuba is in the initial stages of the *most exciting oil exploration boom* that we have seen in many years. Sparking the Cuban oil play, is a set of *6 uniquely dynamic conditions:*

- A huge $35,000,000 oil exploration rush covering practically every one of Cuba's 28,000,000 acres.
- An indicated Cuban oil basin amazingly similar to that found along the lush Texas-Louisiana Gulf Coast petroleum crescent.
- "More physical evidences of oil than any other country in the world" according to E. L. DeGolyer, dean of American geologists.
- The most generous set of foreign oil laws to be found anywhere in the world.
- A 55,000 bbl. a day home petroleum market poised to triple in size almost the moment any "big discovery" blows in.
- A geographical location so ideal that Cuban oil could undersell oil from nearly any other part of the world in the lucrative U. S. east coast market.

Today 34 oil companies are giving Cuba a giant double-barreled oil play—onshore and off! Thus, 1956 may easily become "the big year" for Cuban discoveries and for profits in small Cuban oil stocks—profits perhaps duplicating those just witnessed in Israeli oil stocks which, when that country's first discovery blew in, multiplied 4-to-5 times in price almost overnight.

More specifically, these big-gain prospects can be found in the low-priced stocks of a handful of Cuban companies which together control over 80% of the island's oil basin. Obviously, here is a situation offering outstanding gain opportunities. But, here's the one big compelling reason why you should get the facts on these under-$5 potential Cuban oil-discovery-upsurge stocks immediately.

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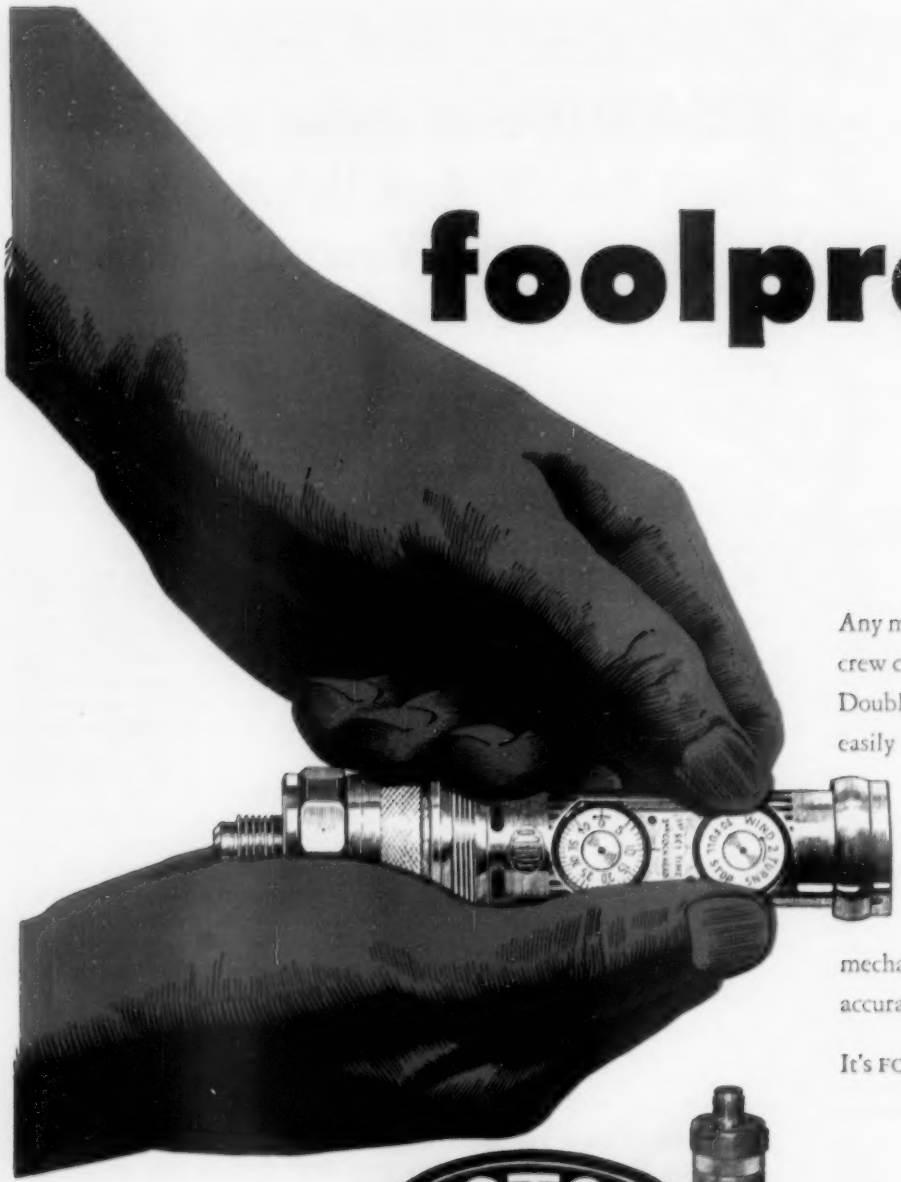

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logged sands showing gas and condensate but was not tested. Operators now are preparing to reenter this hole and test. Its location is slightly more than 1 mile southwest of the Hebert well.

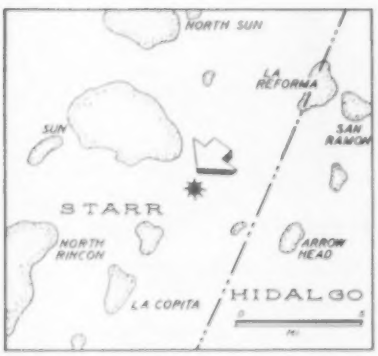
SOUTHWEST TEXAS

Two Zone Gasser Opens New Starr County Field

Claud B. Hamill has a new dual-zone gas-discovery in northeastern Starr County, in the Rio Grande Valley area. It is in his 1 Perez Unit, in the CCSD&RGNG Survey 285, 30 miles northeast of Rio Grande City. It is in wildcat area about 2½ miles southeast of Sun field, and about the same distance northwest of South La Reforma field, near the Hidalgo County line.

Production is from Frio-Vicksburg sands with perforated intervals at 6,174-78 ft. and 5,938-48 ft. Hole was drilled to 6,816 ft., and is cased through the pay zones to 6,250 ft.

The lower zone tested 1,300,000 cu. ft. of gas per day through 11/64-in. choke with pressure of 1,960 psi. Flow from the upper zone was at the rate of 1,450,000 cu. ft. per day, also with 11/64-in. choke. Its pressure was 2,175 psi.



Location (indicated by arrow) of Claud Hamill's new gas-discovery well in northeastern Starr County.

PACIFIC COAST

CALIFORNIA

Standard Misses Again at Fillmore

Standard Oil Co. of California missed on its latest deep wildcat at Fillmore in Ventura County. The operator suspended operations at 14,500 ft. on 1 Kuentsler Unit spudded in last October 1 mile west of Fillmore field production.

This wildcat was plagued with fishing troubles. First mishap occurred when drill pipe was stuck at 13,424 ft. Unable to recover the fish, Standard plugged back and redrilled to 13,940 ft. The test was again plugged back and redrilled to total depth. The hole was then plugged back for the third time to 13,844 ft. for the last unsuccessful test before operations were suspended.

Standard has two other wildcats working in the area. The 14,200 ft. 1 Culbertson-Strickland was being tested on the way out of the hole while the other, 2-1 C. W. West, was fishing drill collars. The former test is located 1½ miles southwest of field production while the 14,249 ft. 2-1 C. W. West is located 1½ miles north of production. Standard has an investment of well over a million dollars in these three wildcats.

Union to Join Strand Stevens Play

Union Oil Co. of California announced plans to drill a wildcat 1 mile northwest of Shell Oil Co.'s two deep pool discoveries in the Posuncula area of Strand field, Kern County.

This test, 73-2 Smith, will be aimed

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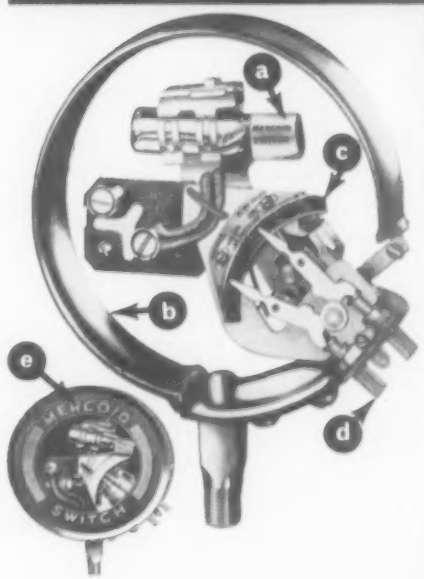

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at the Stevens sand with total depth programed for about 10,500 ft.

Shell's lower Stevens discovery, 73X-12 KCL A, was completed in the new zone at 9,518-79 ft. for 696 bbl. daily last year. This well is 1 mile southwest of Union's announced wildcat. Shell's other important find in this region was 1 Posuncula which it completed at 12,360-12,410 ft. for a Vedder sand discovery. This Vedder well is about ¼ mile north of Shell's deeper Stevens discovery.

Sunray Nears Depth Mark

Sunray Mid-Continent Oil Co. was less than 100 ft. away from a new depth mark for the Tejon area of southern Kern County with 23-11 S. P. Tejon. This wildcat, located 4 miles northeast of Tejon field production, was drilling below 13,140 ft. Standard Oil Co. set the mark of 13,239 ft. with a wildcat drilled several years ago 4 miles southwest of Sunray's deep test. Standard's well was unsuccessful.

Mount Poso Activity Watched

San Joaquin Valley operators were watching with interest Signal Oil & Gas Co.'s wildcat 2½ miles west of Mount Poso field production in Kern County. Signal was reaming to run casing in this wildcat which has total depthed at 2,621 ft. About 1½ miles east of Signal's test, Intex Oil Co. announced plans to drill a Vedder sand wildcat with a programmed depth of 2,200 ft.

Both Union Oil Co. and General Petroleum Corp. have drilled dry holes in the past near Intex' Mount Poso sites.

Imperial Valley Test Slated

Carrizo Valley Oil Co. has staked a location for a wildcat in Imperial Valley. The well, 1-13, will be drilled on a site just inside San Diego County, about 30 miles west of El Centro and 22 miles north of the Mexican border. The last drilling in this area was an unsuccessful five-well program carried out by The Texas Co. in Imperial County in 1952.

Hit New Pool at Pyramid Hills

Franco-Western Oil Co. completed 81-29 Drilexco-Westslope for a new pool discovery in the Avenal sand at Pyramid Hills field in Kings County. This test, located NE NE 29-24s-18e, was brought in flowing 68 bbl. daily of 34°-gravity crude through a 6/64-in. choke. The producing interval is 4,390-4,407 ft. The top of the Avenal sand was found at 4,378 ft. This discovery is on the south flank of the field.

ROCKY MOUNTAIN

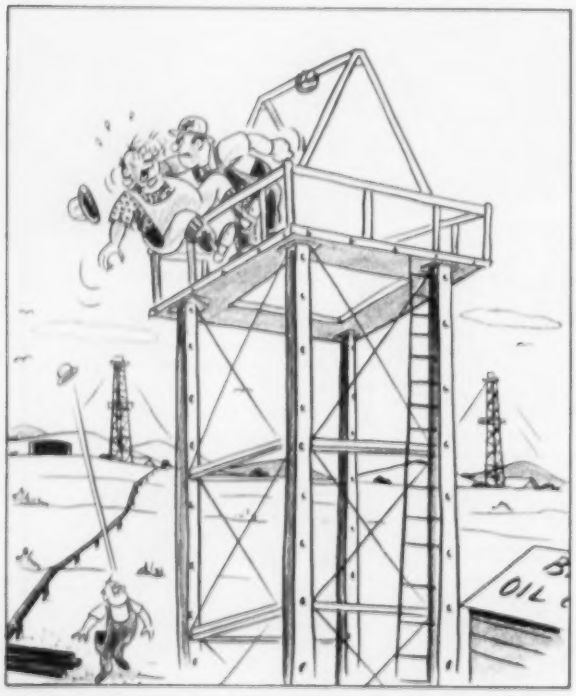
MONTANA

Elk Basin Sand Hit Reported at Berwind Unit

Mountain States Drilling Co. and Phillips Petroleum Co. reported an indicated Elk Basin sand (Upper Cretaceous) discovery at the Berwind Unit in Carbon County, Montana, just north of the Wyoming state line.

The team reported recovery of 10-15 per cent oil-cut mud on three drill-stem tests at the 1 Northern Pacific in C Lot 2, 33-9s-21e, 9 miles west of Clark Fork field. The well, 9 miles northwest of Badger Basin field, lost circulation before tests were run. There was heavy mud loss into the formation.

The drilld-stem test of the Elk Basin sand was made at 8,618-76 ft. Recovery was 4,700 ft. of oil and gas-cut mud, 10-15 per cent oil. The operators made another test at 8,607-76 ft., getting 6,480 ft. of oil and gas-cut mud, also 10-15 per cent oil. The third test was made at 8,587-8,700 ft., recovering 6,150 ft. of oil and gas-cut



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Mountain States Drilling Co. and Phillips Petroleum Co. have an Elk basin sand discovery on the Berwind Unit, Carbon County.

mud. Logs are being run. Total depth is 8,700 ft. The well is a proposed Tensleep test to 14,500 ft. There has been no previous drilling in the immediate area.

NEBRASKA

Oil Flow Reported At Banner County Test

Miracle-Fifer Drilling Co. and Gibraltar Oil Co. 1 Vedene, C NW NW 2-17n-56w, 3½ miles southwest of Lowercheck field in Banner County, flowed 280 bbl. of oil daily from "D" sand perforations at 6,448-54 ft. The discovery is located in an area of little previous drilling, according to reports.

COLORADO

Testing Continues at North Douglas Creek

The North Douglas Creek discovery of Phillips Petroleum Co. in Rio Blanco County recovered 125 bbl. of oil per day on pump on the latest tests of the Weber-Pennsylvanian sand.

The 1 Douglas "A," E½ NW NE 19-1s-101w, is producing through perforations at 7,541-75 and 7,517-23 ft. The company is coring below 5,108 ft. at the 1 "B" Douglas, confirmation well to the discovery in the S½ NW SE 18-1s-101w. Location of this new discovery area is 15 miles northeast of Hells Hole Canyon, north of the Douglas Creek unit.

Oil Discovery Completed In Washington County

Lion Oil Co., a division of Monsanto Chemical Co., has completed the 6 Stites as an oil discovery well in Washington County, Colorado.

The wildcat well, located 8-1s-56w, had an initial production at the rate of 353 bbl. of oil per day through a 24/64-in. choke. Production is from the "J" sand through perforations from 5,388 to 5,391 ft. Total depth of the new well is 5,510 ft.

NORTHWEST NEW MEXICO

Testing Under Way at New San Juan Discovery

British American Oil Producing Co. 1 Marya, NW NE NE 1-25n-13w, San Juan County, flowed 5 bbl. of oil in ½ hour on tests at 4,832-93 ft. The new strike is 3 miles northwest of Bisti pool, a Gallup producer.

NORTH DAKOTA

Divide County Discovery Testing on Pump

The Divide County Madison discovery, Phillips Petroleum Co. 1 Braathen, NE NW 29-162n-95w, pumped 45 bbl. of oil on the first day of tests. This wildcat, 20 miles north of Tioga field, has not been active since early January. More tests are due at the well before proper evaluation can be made of the well's worth.

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ARK-LA-TEX

EAST TEXAS

Potential Run on Opener Of Christmas Day Field

Stephens & Peveto's 1 Fla Lewit, Titus County Paluxy and Rodessa discovery, has taken official completion potentials.

Paluxy perforations at 4,702-14 ft. produced 230.22 bbl. of 33° oil a day through 14/64-in. choke. Tubing pressure was 260 psi. and gas-oil ratio was 207:1.

Gas and condensate from the Rodessa at 6,449-54 ft. gaged 3,600 M.c.f. per day, plus 99.3 bbl. of liquids per 1,000 M.c.f. of gas. Flowing pressure read 2,710 psi., and gravity of the condensate was 6.12°. Choke size was not reported. Gas-liquid ratio was 10,495:1.

Location of 1 Lewis is in M. V. Delgado Survey, A-159, 1½ miles north of production in Talco pool.

This area is attracting much attention and additional drilling. Stephens & Peveto 1 W. A. Ford estate, M. V. Delgado Survey, and a 1-mile northeast outpost to the discovery, had a Stephens Drilling Co. rig on location. The same operators' 1 McLean & Hargrove, in the same area as the discovery but in J. W. Nugent Survey, A-406, had a Hollandsworth Drilling Co. rig and materials moving in. Both are 6,500-ft. projects.

Smith County prospect . . . Pettit oil production northeast of Good Omen pool was in prospect at L. A. Grelling 1 Smith heirs. Operators were running pipe for tests on the basis of a core from 8,172-99 ft. The core included 12 ft. of lime, grey to tan, porous and slightly porous with good oil odor and stain, in the center of a 27-ft. recovery.

Location of 1 Smith is in Ben Lafferty Survey, A-13, which is approximately ½ mile northeast of the same operator's 1 Wilkinson, lone Pettet producer in Good Omen pool. Pay here was through perforations at 8,200-10 ft., with a final potential last August of 206 bbl. daily.

New well at New Hope . . . Tide Water Associated Oil Co. 1-D Rhoades "A," Smackover test in the New Hope field 9 miles south of Mount Vernon, was running casing for completion tests. Perforations to be tested are in the Smackover at 11,870-12,276 ft.

GREAT LAKES

MICHIGAN

A new stepout well, located ½ mile (second 40-acre location) east of the William Cline 1 Gas Co., 1 mile east extender of the Reed City zone, Reynolds oil pool, Montcalm County, was at 5-in. casing point and ready for early drill-in this week.

This new and important well on further east was the Aurora Gasoline Co. and McClure Oil Co. 1 Dennis, SE NW SW 5-12n-9w, Winfield Township. Dundee top was picked at 3,387 ft. and long string of 5-in. casing was set at 3,475 ft. While this well was checked in structurally lower by 12 ft. on Traverse in comparison with this closest producer, on the Dundee it was checked in only three short of where Dundee was logged at the Cline extender. This appeared to give the 1 Dennis excellent prospect of "catching" the Reed City dolomite porosity zone. A good producer at this location will stimulate even more activity in the area.

The Reynolds Dundee - Reed City zone oil pool, discovered in 1954, has developed in recent months as one of Michigan's most important areas for major oil-field development.

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Successful Wildcats

CALIFORNIA

Kern County: Richfield Oil Corp. 52-36 KCL F, NE NW 36-11n-20w, BOPD 154, 41.5° gravity, 48/64-in. choke, perfs. 8,948-9,042 ft., TD 9,213 ft. plugged back to 9,044 ft. (New field discovery 2 miles southeast of Wheeler Ridge field in southern Kern County.)

Kings County: Franco-Western Oil Co. 81-29 Drilexco-Westslope, NE NE 29-24s-18e, BOPD 68, 34°-gravity, 6/64-in. choke, perfs. 4,390-4,407 ft., TD 4,470 ft. (New pool discovery on southeast edge of Pyramid Hills field.)

SOUTHWEST TEXAS

Bexar County: J. D. Collins 1 Prinz, James Jordan Sur. 45, A-374. IP 74 BOPD, 7/16-in., 22°, Navarro 1,132-1,214 ft. (Open hole). TD 1,246 ft. (New field.)

Brooks County: Magnolia Petroleum Co. 21 Strachn, Lot 9, Blk 9, W. W. Jacobs Subd. IP 173.4 BOPD, 9/64-in., 42.6°, GOR 1,491 cu. ft. per barrel, perforations 7,552-58 ft. TD 7,640 ft. (New pay in LaGloria field.)

Duval County: The Texas Co. 3-B Duval County Ranch, NCT-32, Norman G. Collins Sur. 203, A-918. IPP 99 BOPD, 20.8°, perforations 2,033-39 ft. (Chernosky sand). TD 2,410 ft. (New pay in Petrox field.)

Duval County: Magnolia Petroleum Co. 3 Humble-Duval Ranch, BS&F Sur. 204. IPP 59.28 BOPD, 21.5°, perforations 2,286-89 ft. (Government Wells sand). TD 2,330 ft. (New pay in Petrox field).

Henshaw Brothers 3 Alonzo Taylor, Trinidad Vela EL Mesquite Grant, A-612. IPP 72.02 BOPD, 35°, perforations 3,750-52½ ft. TD 3,757 ft. (New field—Alonzo Taylor).

Jim Wells County: La Gloria Oil & Gas Co. 5 Stewart-Jones Unit 1, J. E. Stevens Sur., A-442 and 444. IP 29 BOPD net, 3/32-in., 40°, 35 per cent water, perforations 7,300-03 ft. TD 7,802 ft. (New pay in T-C-B field).

McMullen County: Argo Oil Co. 1-T Edrington, AB&M Sur. 59. IP 7,100 M.c.f. daily, open-flow potential, 9.98 BC per M.M.c.f., 48.2°, perforations 8,875-8,910 ft. (lower Wilcox), and (dual completion) 32,000 M.c.f. daily, open-flow potensial, 18.05 BC per M.M.c.f., 52.1°, perforations 7,890-7,995 ft. TD 9,522 ft. (New field).

TEXAS GULF COAST

Brazoria County: Superior Oil Co. 1 Lockhart Bank Unit, Blk 47, Myles O'Donnel Sur., A-488. IP 25.3 BCPD and 3,600 M.c.f. daily, ¼-in., 43.7°, perforations 9,950-58 ft., and (dual completion) 58.7 BCPD and 6,175 M.c.f. daily, 9/32-in., 43.7°, perforations 9,780-90 ft. TD 11,191 ft. (New pays and extends Alvin City field.)

Fayette County: Sutton Drilling Co. 1 Paulus Warren Unit, M. C. Salinas Sur., A-288. IPP 26.83 BOPD, 26°, perforations 2,219½-25½ ft. TD 2,272 ft. (New pay in Julie Ann field.)

Kenedy County: Humble Oil & Refining Co. 12 Armstrong, Barreta Grant. IP 179.78 BOPD, ⅝-in., 41°, perforations 8,608-18 ft. TD 9,700 ft. (New pay and extension Candelaria field.)

Live Oak County: Stanolind Oil & Gas Co. 1 H. O. Duty Gas Unit, ACH&B Sur., Blk. 82, A-69. IP 5,000 M.c.f. daily, open-flow potential, GLR 59.4 M.c.f. per bbl., 50.3°, perforations 6,965-76 ft. TD 7,333 ft. (New field.)

Nueces County: Arkansas Fuel Oil Corp. 1 State Tract 14, Corpus Christi Bay. IP 5,000 M.c.f. daily, open-flow potential, 32 BC per M.M.c.f., 62.3°, perforations 8,608-12 ft. TD 10,175 ft. (New pay and extension in Northwest Corpus Channel field.)

Nueces County: Burdette Graham and associates 1 Kleberg, Share 3, Partition of Wright lands, Herra Grant, A-2661. IP 12,000 M.c.f. daily, open-flow potential, GLR 31 M.c.f. per bbl., 58°, perforations 6,626-30 ft., and (dual completion) 5,600 M.c.f. daily, open-flow potential, 57°, perforations 6,494-99 ft. TD 6,647 ft. (Extension and new pays in North Agua Dulce field.)

Sun Oil Co. et al., 1 State Tract 277, Redfish Bay (Stedman Island area). IP 17,200 M.c.f. daily, open-flow potential, GLR 46.1 M.c.f. per bbl., 54.2°, perforations 8,194-8,204 ft. (Frio). TD 13,000 ft. (New field.)

San Patricio County: Houston Oil Co. 7-A Hattie Baldwin et al., Sec. 47, G. H. Paul Subd. of Coleman-Fulton Pasture Lands. IP 152.84 BOPD, 5/32-in., 44°, perforations 5,953-56 ft., and (dual completion) 56.8 BOPD, 3/32-in., 38.9°, perforations 5,594-98 ft. TD 7,014 ft. (New pays in East White Point field.)

SOUTHEAST NEW MEXICO

Eddy County: W. H. Black 1 State-Lowe, 32-19s-30e. IPP 135 BOPD, 30°, GOR zero, Yates 1,666-74, 1,630-40 ft. TD 1,832 ft.

WEST TEXAS

Andrews County: Shell Oil Co. and Cities Service Oil Co. 8 King, 10-A42-PSL, 8

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mi. W Andrews. IP 242 BOPD, 20/64-in. TP 250 psi., GOR 740, 44°, Devonian top, and top of pay, 9,998 ft., elev. 3,217 ft. TD 12,600 ft., PB 10,125 ft.

Dawson County: Montex Drilling Co. 1 Scanlan, 83-M-EL&RR, 6 mi. W Welch. IPP 25 BOPD, 32°, GOR 110, San Andres pay 4,880 ft. TD 4,932 ft., elev. 3,117 ft.

Ector County: Gulf Oil Corp. 774 Goldsmith, 40-44-T1S-T&P, 7 mi. S. Goldsmith. IPP 57 BOPD, 39.8°, GOR 619, Pennsylvanian 8,405-55 ft. TD 11,680 ft. Ground elev. 3,168 ft.

Stanolind Oil & Gas Co. 1 Midland Farms, "AJ" R/A "B," Sec. 37, Blk. 42, T1N, G&MMB&A Sur., 6 mi. NE North Cowden. IP 278 BOPD, ¼-in., TP 500 psi., GOR 551, 39°, Pennsylvanian 10,158-84 ft. TD 13,228 ft. Elev. 3,089 ft.

Gaines County: Cities Service Oil Co. 1 Corrigan, 390-G-CCSD&RGNG, 16 mi. NW Seminole. IP 608 BOPD, 32/64-in., TP 90 psi., GOR 70, 29°, lower Spraberry 8,742-86 ft. TD 10,938 ft., PB 9,104 ft. Elev. 3,474 ft.

Gaines County: D. W. St. Clair 1 Branch, 326-G-CCSD&RGNG, 10 mi. SW Seminole. IP 308 BOPD, 1-in., TP 100 psi., GOR 1500, 34.5°, Clear Fork 7,114-7,220 ft. TD 7,320 ft., ground elev. 4,480 ft.

Lynn County: W. Ridley Wheeler 1-G Legg, Sec. 1274, EL&RR Sur., 4 mi. SW Southland. IP 226 BOPD, ⅝-in., TP 125 psi., GOR 195, 36°, Glorieta, perforated intervals between 4,229-4,396 ft. TD 4,549 ft., elev. 3,005 ft. New pay in Sunland-San Andres field.

Sterling County: Sun Oil Corp. 1 Blanche Lee Stringer, 11-11-SPRR, 10 mi. SE Sterling City. IPP 24 BOPD, 28.5°, GOR zero, San Angelo 1,426-36 ft. TD 7,700 ft.

Upton County: The Texas Co. 1-A Shirk, 23-2-MK&T, 8 mi. NE McCamey. IPP 78 BOPD, 38°, Wolfcamp 7,170-94 ft. TD 11,098 ft.

EAST TEXAS

Cherokee County: Monsanto Chemical Co. 1 Bolton, J. J. Benson Sur., A-142, 4 mi. N Maydelle. IP 1,275 M.c.f. gas, plus 26.6 bbl. 60° condensate. 14/64-in., TP 1,055 psi., Woodbine 4,677-82 ft. TD 9,716 ft. Top pay 4,677 ft., elev. 312 ft. Formation tops: Goodland 6,280 ft., Paluxy 6,493 ft., James 8,950 ft., Travis Peak 9,400 ft.

NORTH TEXAS

Clay County: Armour Properties 1-B Scaling "1," Blk. 51, J. H. Belcher Subd., 4 mi. SW Joy. IP 217 BOPD, 18/64-in., TP 100 psi., 42° GOR 550, Strawn 4,503-14 ft. TD 4,650 ft.

Knox County: Thomas D. Humphrey & Sons 1 Oliver, Blk. 2, R. E. Farrar Sur., A-1632, 3 mi. W Knox City. IPP BOPD, 38.6, GOR 180, Strawn 4,868-72 ft. TD 4,958 ft. Suggested new field name, Noba-Strawn.

Wilbarger County: Monsanto Chemical Co. 1 Igou, 59-15-H&TC Sur., A-464, 12½ mi. N Vernon. IPP 20 BOPD, 40°, GOR 1500, conglomerate 5,897-5,917 ft. TD 5,990 ft.

J. K. Wadley 1 Adams, 55-15-H&TC, 11 mi. NE Vernon. IP 186 BOPD, 24/64-in., TP 80 psi., GOR 300, 43°, Strawn conglomerate 6,031-49 ft. TD 6,090 ft., ground elev. 1,170 ft. Suggested field name, Fargo East.

WEST CENTRAL TEXAS

Coleman County: R. W. Cupps 1 Haynes, Subd. 1, P. Young Sur. 494, 4 mi. NW Trickham. IPP 5 BOPD, 40°, GOR zero, pay 1,160-70 ft. TD 1,243 ft.

E. W. Griffin 1 Harbin, 9-4-H&TC, 5 mi. N Eastland. IPP 12 BOPD, 39°, GOR zero, pay 1,561-71 ft. TD 1,901 ft.

Comanche County: J. J. Bell 1 Underwood, 27-9-D&DA, 7 mi. SW Gorman. IP 22 BOPD, 8/64-in., TP 210 psi., GOR 450, Marble Falls 2,658-72 ft. TD 2,688 ft.

Fisher County: Ray Smith 1 Green and Weatherman, 123-1-H&TC, 7 mi. NE Rotan. IPP 76 BOPD, 40°, GOR 400, Strawn 5,703 ft. TD 5,212 ft. ground elev. 1,891 ft.

Jones County: Thomas D. Humphrey & Sons 1 Parham, J. M. Cloud Sur. 269, 4 mi. N Noodle. IP 210 BOPD, 16/64-in., TP 210 psi., 38°, Cisco sand 3,555-69 ft. TD 3,826 ft. New field name, Huddleston South.

Jones County: Stroube Central & Panhandle Oil Corp. 1 Ellison, 51-18-T&P, 2½ mi. W Noodle. IPP 10 BOPD, 40°, Noodle Creek lime 2,518-28 ft. TD 3,207 ft.

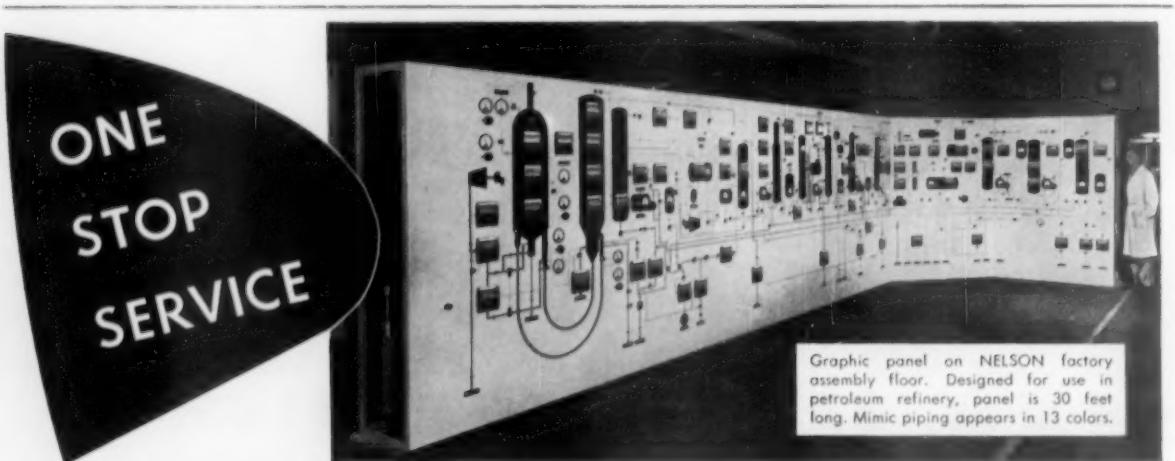
Taylor County: Chicago Corp. 1 Arnett Weeks, Geo. Hancock Sur. 447, new pay discovery in Atwood West field, 4 mi. SW Lawn. IP 312 BOPD, ¼-in., TP 400 psi., 39°, GOR 707, Morris sand 3,745-64 ft. TD 3,786 ft., elev. 1,944 ft.

Hack Drilling Co. 1 Powell, Sec. 67, LAL Sur., 3 mi. N. Tuscola. IPP 79 BOPD, 40.6°, GOR zero, Flippen sand 2,096-2,110 ft. TD 2,240 ft. Suggested new field name, McGill-Flippen.

OKLAHOMA

Alfalfa County: Woods Petroleum Co. 1 Tucker, 2½ miles southwest of Southeast Flowerdale in SE SE 13-28n-10w. IPF 392 BOPD, Bartlesville sand 4,922-37 ft., 18/64-in. choke, 38°, TD 5,012 ft. (Oil discovery).

Beaver County: O. H. Parker 1 Pruett, C SE



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NW 30-2n-24eCM. IPF 120 BOPD, ½-in. choke, 53°. Atoka sand 7,464-80 ft. TD 7,661 ft. (Oil discovery in Hugoton embayment).

Cleveland County: Weiner, Fitzhugh, J. N. Ingraham, 1½ miles northwest of East Noble in NW SW 24-8n-2w. IPF 381 BOPD, second Wilcox sand 7,890-95 ft., 40°, 12/64-in. choke. TD 8,673 ft. (Oil discovery in southeastern Anadarko basin.)

Grady County: British-American Oil Producing Co. 2 Harrison, SE NW NE 29-3n-5w. IPF 353 BDPD, 2,261 M.c.f. of gas per day, third Bromide sand 15,250-15,-310 ft., 10/64-in. choke, 54.9°. TD 15,-310 ft. (Oklahoma's deepest producer).

McClain County: Sun Oil Co. 1 Campbell, ¼ mile north of McGee in SE NE SW 33-5n-2e. IP 1,788 M.c.f. of gas per day, Layton sand 3,244-50 ft., 28/64-in. choke. TD 3,976 ft. (Gas discovery in Arbuckle Mountains province).

ARKANSAS

Conway County: Carter Oil Co. 1 Morrilton Lumber Co., 11 miles east-northeast of Moreland field in C NW SE SW 33-9n-17w and 1¾ miles south of Jerusalem. IP 5,205 M.c.f. of gas per day, 1,938-62 ft. Atoka-Penn. sand. TD 3,500 ft. (Gas discovery in McAlester-Arkansas River Valley basin).

Ouachita County: Don H. Peaker et al. 1 Reynolds Bros., SW NW 27-15s-15w. IPP 116 BOPD, ¼-in. choke, 39°. Lower Cotton Valley 4,602-13 ft. TD 4,850 ft. (Oil discovery, new pay in Smackover-Snow Hill field.)

KANSAS

Ellis County: Aledo Oil & Gas Co. 1 Heyl, NE NE NW 20-14s-17w. IP 70 BOPD, Arbuckle. TD 3,520 ft. Opens Heyl pool.

K&E Drilling Co. and Oil Trading Co. 1 Schmidt "B," NW NE SW 34-12s-17w. IP 110 BOPD, Lansing. TD 4,013 ft. Opens Southeast Schmeidler pool.

Graham County: Petroleum, Inc. 1 Lacerte, NW NE SW 32-10s-22w. Completing in Lansing. TD 4,013 ft. Opens Lacerte pool.

Harper County: Roland Pelt 1 Hanness, NW SW NE 4-33s-7w. Completing in Simpson. TD 4,918 ft. Opens South Banner pool.

Marion County: Sunflower Drilling Co. 1 Utting, SE SE NW 34-18s-4e. Completing in Mississippian. TD 2,308 ft. Opens Beauty pool.

E. K. Carey 1 Ratzlaff, C SW SE 7-19s-2e. Completing in Viola. TD 3,140 ft. Opens Ratzlaff pool.

Pratt County: Bankoff Oil Co. 1 Johnson, NW NW SE 25-28s-15w. IP 120 BOPD and 800 M.c.f. of gas per day, Mississippian. TD 4,839 ft. Opens Cullison pool.

Sedgwick County: Ed Adair 1 Deffner, NE SE NW 7-29s-1e. Waiting on potential from Kansas City lime. TD 3,208 ft. Opens Southwest Glayds pool.

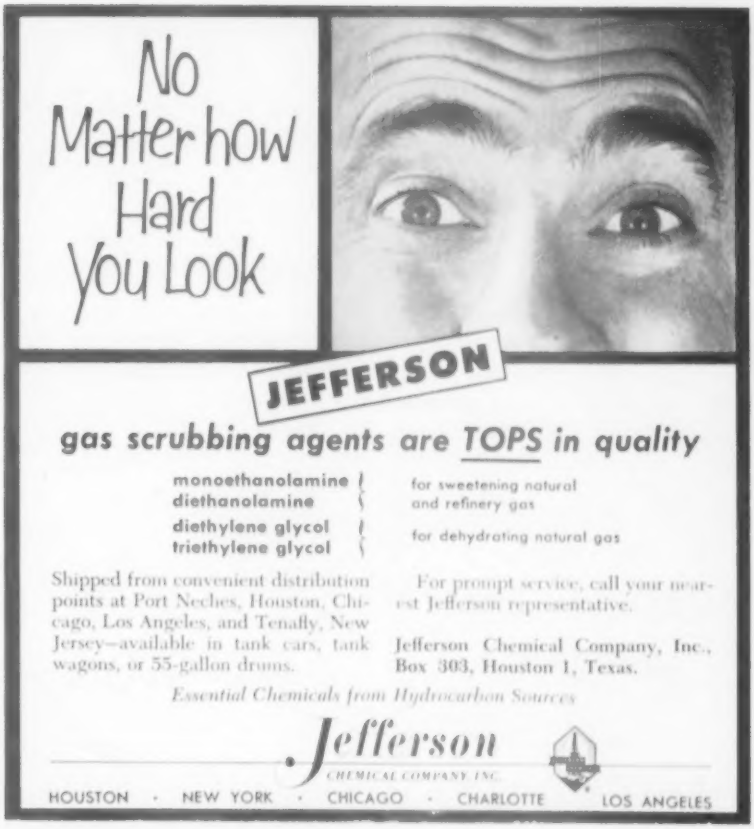
Stafford County: Transit Corp. 1 Krankenberg, SW SW SE 19-22s-12w. Waiting on potential from Simpson. TD 3,761 ft. Opens Krankenberg pool.

Trego County: Transit Corp. 1 Kroeger, SE NW SE 36-13s-21w. Completing in Arbuckle. TD 3,970 ft. Opens Kroeger pool.

SOUTH LOUISIANA

Beauregard Parish: Sunray Mid-Continent Oil Co. 1 Lutcher-Moore, 10-7s-12w. IP 1,200 M.c.f. daily and 72 BC per M.M.c.f., ⅛-in., 52°, perforations 8,594-8,614 ft. TD 9,025 ft. (New field.)

St. Mary Parish: Sun Oil Co. 2 St. Mary, 25-17s-10e. IP 260 BOPD, ⅛-in., 32.6°,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perforations 13,498-13,504 ft. TD 13,568 ft. (New pay in Belle Isle field.)

Terrebonne Parish: Sun Oil Co. 1 State Lease 2620, 22-22s-18e. IP 300 BOPD, 9/64-in., 31.7°, perforations 15,526-36 ft. TD 16,021 ft. (New pay and extension in Lake Pelto area.)

Acadia Parish: Austral Oil Exploration Co., Inc., 1 Hayes et al., 36-8s-1w. IP 72 BCPD and 5,200 M.c.f. daily, ⅞-in., 42°, perforations 11,141-50 ft. TD 11,250 ft. (Extends West Maxie area.)

Calcasieu Parish: San Jacinto Petroleum Corp. 1 Cormier-LeBleu Unit, 33-10s-8w. IP 78.5 BOPD, 3/32-in., 41°, perforations 8,922-37 ft. TD 9,818 ft. (Tentative extension of South Lake Charles field—may be new field.)

ALABAMA

Fayette County: N. E. Jones 1 Deavours, 25-15s-11w. IP 180 M.c.f. daily (estimated), ⅜-in., dry gas, perforated 3,932-38 ft. (Mississippian). TD 4,998 ft. (New field.)

MISSISSIPPI

Monroe County: Pure Oil Co. 1 Murphree, 28-12s-6e. IP 3,737 M.c.f. daily, ½-in., (calculated open-flow potential 5,950 M.c.f. daily), dry gas, perforations 2,012-44 ft. (Mississippian-Carter sand). TD 4,489 ft. (New field—Okolona.)

MONTANA

Carbon County: British American Oil Producing Co. 1 State, C NE SE 16-9s-22e. IPF 275 BOPD, Lakota discovery, new field. TD 10,877 ft.

NEBRASKA

Kimball County: R. W. McDowell, Jr., et al 1 State 778, C NW NW 16-13n-58w, IPP 25 BOPD, J sand discovery, new field. TD 7,450 ft.

Maxey Drilling Co. 1 Evertson, C SE NE 30-14n-55w. IPP 240 BOPD, J sand discovery, new field. TD 6,481 ft.

SASKATCHEWAN

Mobil Oil 34-9 North Roncott, LSD 9, 34-5-52w2, TD 6,070 ft. Baken silt (Mississippian) oil well.

WEST VIRGINIA

Tucker County, Clover district: Hope Natural Gas Co. 9967 Walter Hovatter, elevation 2,016 ft., 2,236,000 cu. ft. gas, after shot, chert 4,955 ft., Oriskany sand 5,120 ft., gas 5,222-28 ft. TD 5,235 ft.

WYOMING

Converse County: C. C. Thomas 1 Government, C SW SE 34-34n-69w. IPF 70 BOPD, Mesaverde discovery, new field. TD 7,265 ft.

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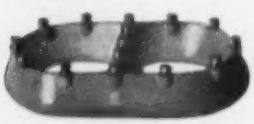

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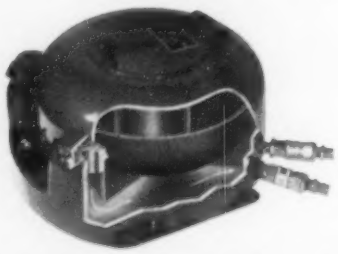

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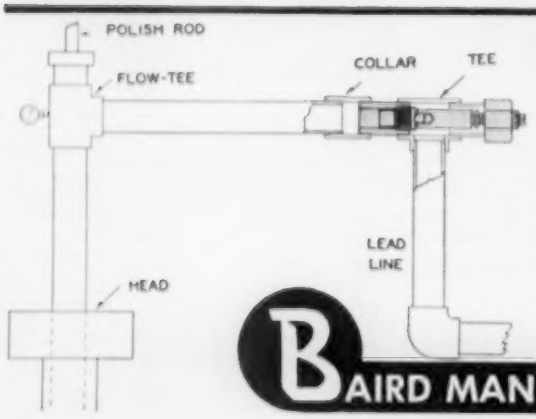

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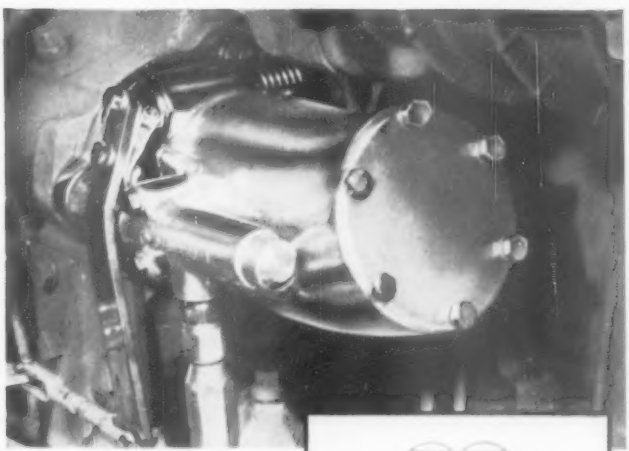

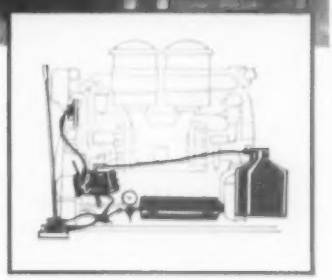

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MANAGEMENT TEAM includes Wayne H. Dean, left, a graduate of the "crown block" school, and George H. W. Bush, of Yale. It's an Ivy League, roughneck combination as . . .

Zapata Enters a Rugged Field

HOW do a young Harvard man and a young Yale man get into the rugged offshore drilling business? Simple. They join forces with a man who got his higher education from the crown block of a drilling derrick.

The three men attracted national attention last week when the company they formed, Zapata Off-Shore Co., took delivery of a seagoing drilling platform fondly referred to as their "three-legged monster."

J. Hugh Liedtke, the Harvard man, and George H. W. Bush, of Yale, had been in the oil and drilling business at Midland, Tex., for several years before deciding to wade into the tidelands. In late 1954 they formed Zapata Off-Shore.

"When we did," explains Bush, 31-year-old president of the firm, "we needed a man who knew the business, and we went out and got Wayne Dean."

. . . Wayne H. Dean, now vice president, manager of operations, and a big stockholder, started his oil-field career as a roughneck at the age of 17.

During the next 17 years he moved up from roughneck to driller, toolpusher, and general superintendent.

In 1943 Dean joined The California Co. and took charge of drilling operations in eight states. Leaving that company in 1947, Dean went to Kerr-McGee Oil Industries, Inc., as Rocky Mountain division drilling superintendent. He joined the migration of oil men to the tidelands in 1948 when he moved to Morgan City, La., as manager of Gulf Coast offshore operations for Kerr-McGee.

After supervising the drilling of some of the first offshore wells, Dean was transferred to Oklahoma City in 1953 as manager of all Kerr-McGee drilling operations both in this country and abroad. He resigned from that company in the fall of 1954 to help form Zapata Off-Shore. He has been living in Houston since then.

. . . J. Hugh Liedtke was born at Tulsa 34 years ago. He received his BA degree from Amherst College in 1942 and was graduated from Harvard Business School the following year. After serving aboard an aircraft carrier in the Pacific during World War II he got his law degree from the University of Texas.

LIEDTKE

Settling in Midland, he entered the oil business as a partner in Liedtke & Liedtke. In 1953 he helped organize Zapata Petroleum Corp., Midland, which owns about 48 per cent of the stock in Zapata Off-Shore.

Besides serving as president of Zapata Petroleum since its founding, young Liedtke also is a co-founder, officer, and director of Zavala Oil Co., Zapata Drilling Co., and Zapata Off-Shore.

Liedtke is married and has three children. He resides at Midland, from where he directs the operations of five West Texas rigs for Zapata Drilling Co.

. . . George H. W. Bush, a native of Milton, Mass., grew up at Greenwich, Conn. His father, Prescott Bush, is now senior senator from Connecticut.

The youthful Bush won the Distinguished Flying Cross for World War II service as a naval pilot. Discharged in 1945, Bush enrolled at Yale University where he was graduated with a BA degree in economics.

Fresh out of college, Bush strayed to Texas where he joined Dresser Industries, Inc. In 1951 he went into the oil and drilling business. He is a co-founder and vice president of Zapata Petroleum and an officer in Zapata Drilling.

Bush also lives at Midland. He is married and has three sons.

New venture . . . Zapata Off-Shore Co. christened its new drilling platform in elaborate ceremonies at Galveston last week. The unit, known as "The Scorpion," is contracted for about 12 months to Standard Oil Co. of Texas.

Before putting its first platform to work, Zapata was considering long-range plans for a second and bigger unit. R. G. LeTourneau, Inc., designer and builder of the Scorpion, which will operate in 80-ft. water, has preliminary plans for a unit which would operate in water 150 ft. deep.

George T. Piercy, general manager of Esso Standard Oil Co.'s supply department, has been elected a director of Plantation Pipe Line Co.

Milburn J. O'Neal, Jr., Shell Oil Co., Houston, will be honored at the American Chemical Society's 129th national meeting April 9 in Dallas. O'Neal, a group leader in analytical research for Shell, will get the Precision Scientific Co. award for research in petroleum chemistry. He is credited with developing an instrument for identifying components of mixtures containing high-weight petroleum substances.

M. C. Alcorn has been promoted from assistant manager to manager of Shell Oil Co.'s Pacific Coast pipelines department. **F. O. McKeany,** former superintendent of oil movements, succeeds Alcorn. The pipeline department recently was reorganized and transferred from the exploration and production to the transportation and supply department.

Dr. B. W. Thomas has been advanced to senior research specialist in the research and development division of Humble Oil & Refining Co.'s Baytown refinery. Others promoted: **E. M. Adir** and **B. H. Johnson,** to senior research chemists, and **M. T. Waddell,** to patent coordinator in the research and development division; and **B. S. Greenwood** to technical specialist and **W. E. Askey** to senior chemical engineer in the technical services division.

J. T. Holton, Jr., has resigned as petroleum engineer for Gulf Oil Corp. to join Cosden Petroleum Corp.'s western producing division in Odessa, Tex.

Harrell Budd has resigned as district geologist for Southern Union Gas Co. in Farmington, N. M., to join Kilgore and Budd, consultants there.

Conrad J. Holstege has resigned as job engineer with M. W. Kellogg Co. in New York to join Bechtel Corp. in San Francisco.

Leo S. Cichowicz has been promoted by Continental Oil Co. from field engineer in North Cowden, Tex., to district engineer in Odessa, Tex.

Robert E. Eddy has been promoted by Shell Oil Co. from engineer in Ventura, Calif., to senior exploitation engineer in Salt Lake City. Other changes involving Shell exploitation engineers: **Bender Hash,** from Ventura to the area office in Los Angeles; and **Robert MacAlister,** from Bakersfield, Calif., to Shell's New York headquarters.

R. G. Greene, president of Lincoln Oil, Gas & Refining Co., will become president of Great Basins Petroleum Co. next month after Lincoln is merged into Great Basins. **William E. Morgan,** Lincoln vice president, will take the same post with Great Basins. **C. G. Glascock, Jr.,** now president of Great Basins, continues as a director. Both firms are based in Denver.

F. Cushing Smith, former assistant superintendent in the Whiting refinery of Standard Oil Co. (Ind.), has been promoted to assistant to the president, a newly created post. Smith joined Indiana Standard in 1943 as chemical engineer at Whiting. In 1947 he was made technical assistant in the firm's manufacturing department, Chicago, and later became section supervisor, operating superintendent and department manager there. He returned to Whiting in 1953 as general foreman, light oils department.

H. J. Thomas, formerly in Shell Oil Co.'s manufacturing operations department, New York, has been named assistant superintendent of Shell Chemical Corp.'s Martinez, Calif. plant. Other Shell changes: **G. C. Cardwell, Jr.,** engineer, from the Martinez refinery to Shell Chemical's Torrance, Calif., chemical plant; **L. S. Leonard,** technologist, from the Houston refinery to Martinez; and **W. H. Papeman,** from assistant department manager, lubricating oils, Martinez refinery, to Shell's New York headquarters.

Roe A. Gray, a Midland, Tex., independent the past 5 years, has been elected president of Wane Oil Co., Los Angeles. Gray is a former petroleum advisor to the Venezuelan Government.

Minnie Overton and **Leon Akopian,** Van Nuys, Calif., contractors, have set up a new oil and gas consulting department within their partnership.

Robert E. Campbell, has resigned from Garbey Drilling Co. to join Trans-Era Petroleum, Inc., as manager of rotary drilling contract work.

Wallace W. Wilson, chief of Continental Oil Co.'s reserves and evaluation section, has resigned to join the Continental Illinois Bank & Trust Co. as petroleum engineer in the oil and gas department. Wilson, a former chief reservoir engineer for Conoco, earlier worked for California Research Corp. on secondary recovery problems.

Personals

Brame Womack has been promoted by Sohio Petroleum Co., Oklahoma City, from division geologist to division exploration manager. **P. G. Rennie,** district engineer for the firm in Tyler, Tex., has been transferred to Pauls Valley, Okla. **J. Craig Coogen,** senior engineer in Oklahoma City, replaces Rennie in Tyler.

Donald A. Stoltenberg, formerly with Standard Oil Co. (Ind.), has joined Arabian American Oil Co. as liaison engineer. **Bert Golding,** formerly with United Gas Co., Shreveport, joins the firm as petroleum engineer. New additions to Aramco Overseas Co. are: **James A. Suter,** formerly with Clyde Tube Forgings Co., who'll be an inspector in The Hague, the Netherlands; and **Leslie E. Burgess,** to design engineer, also in The Hague.

WRATHER WEAVER MOODY LAW DOTT

A.A.P.G. to Honor Five for Achievement

FIVE men will be honored for distinguished achievement by the American Association of Petroleum Geologists at its annual convention April 24 in Chicago.

William E. Wrather, former director of the United States Geological Survey, will receive the Sidney Powers Memorial Medal, highest honor in the science of petroleum geology.

Paul Weaver, Texas A. & M. College research geologist, and Clarence Moody, Houston, consultant, have been elected honorary members of A.A.P.G.

Two young geologists have been named to receive the President's Award. They are James Law, with California Standard Co. in Calgary, and Lt. Robert H. Dott, Jr., of the Air Force Cambridge Research Center, Bedford, Mass.

For Wrather, the Powers Medal will cap a distinguished career and extend an old habit — he's received almost every other honor bestowed to one in his profession. Wrather was a founder of A.A.P.G. and served as secretary-treasurer in 1918 and president in 1922. Before entering government service, he was with Gulf Oil Corp. and a consultant. He directed the U.S.G.S. from 1943 until he retired in January.

Weaver and Moody are receiving honorary memberships for "distinguished service in the field of petroleum geology." Weaver joined the U.S. Coast and Geodetic Survey in 1908 and the Geological Survey in 1910. A variety of foreign and domestic assignments with private firms began a year later. He joined Gulf Oil in 1926 as superintendent of drilling and production. In 1953 he retired as technical assistant to the vice president to become a consultant. Moody, an authority on Gulf Coast geology, worked for Ohio Oil Co. in Louisiana 35 years before he retired in 1953.

Law and Dott will be honored for the most significant articles contributed last year by authors under 35 to the A.A.P.G. Bulletin. Law's paper deals with "Geology of Northwestern Alberta and Adjacent Areas." Dott's is entitled "Pennsylvania Stratigraphy of Elko and Northern Diamond Ranges."

Personals

William H. Tompkins has resigned as storage engineer for Panhandle Eastern Pipe Line Co. in Kansas City to join C. H. Hinton as production engineer in Amarillo.

J. R. Berryman has resigned as geologist with Arkansas Louisiana Gas Co. in Fort Smith, Ark., to join Texas Gas Exploration Corp. in Owensboro, Ky.

Charles B. Reed has resigned as chief engineer for Newmont Oil Co., Fort Worth, to become an Austin, Tex., consultant. Before joining Newmont in 1951, Reed was an independent geologist in the Mid-Continent area. Earlier he had been supervising seismologist for Shell Oil Co.

Wayne O. Watts has been elected president of North Texas Oil and Gas Association. Other new officers: **Ralph O. Harvey, Jr.,** first vice president; **James W. McCutchen,** second vice president; and **George W. Anderson, Jr.,** executive vice president. They will take office March 31.

D. H. Putney, vice president of Stratford Engineering Co., has been elected president of the Kansas City refinery-engineering firm. Putney joined Stratford in 1936 as chief engineer. Earlier he specialized in refinery construction with Sinclair Refining Co., Cross Construction Co., M. W. Kellogg Co., and Alco Products division, American Locomotive Co.

Horace Shumate has resigned from Gulf Oil Corp.'s production department to join Loffland Brothers Co., Tulsa, as contract representative in the West Texas-New Mexico division. Shumate is 1956 chairman of the Permian Basin chapter of the American Petroleum Institute, and has served as chairman of A.P.I.'s drilling-practices committee.

C. E. Greenwood, assistant to Continental Oil Co.'s southern regional geologist, has been promoted to division geologist, Gulf of Mexico division. The newly formed division will handle all Conoco's Gulf exploration except that conducted by the firm for the C.A.T.C. offshore group. Conoco is operator for the group, which includes Atlantic Refining Co., Tide Water Associated Oil Co., and Cities Service Oil Co. With Greenwood in the new division will be **C. H. Gullick,** former southwestern region geophysical supervisor, who'll be division geophysicist, and **Sam M. Udden,** geologist, who becomes assistant division geologist.

Donald E. Campau has resigned from the Canadian Stratigraphic Co., Calgary, to join Sun Oil Co.'s research department. He'll be headquartered in Billings, Mont.

George V. Myers has been named general manager of production for Standard Oil Co. (Ind.), effective March 19. Myers has been a director and financial vice president of Stanolind Oil & Gas Co., Tulsa, since 1953. Earlier he had been controller of Westinghouse Air Brake Co. and a special agent for the Federal Bureau of Investigation. In his new post Myers will coordinate production and crude oil supply of all Indiana Standard subsidiaries.

Dr. Edward R. Weidlein has retired as president of Mellon Institute of Industrial Research, University of Pittsburgh, after over 40 years there. He will spend the next several months in Europe on a federal government mission.

R. C. Low has joined Oil Trading Associates, Inc., as head of the Houston office. He succeeds **R. L. Berry,** resigned.

Joe E. McGeath, general superintendent of Magnolia Pipe Line Co., Dallas, since 1954, has been elected a director. McGeath joined the firm in 1923 as a roustabout in Smackover, Ark.

Reid Brazell, president of Leonard Refineries, Inc., Alma, Mich., last week was reelected president of Western Petroleum Refiners Association. Four vice presidents were reelected at W.P.R.A.'s forty-fourth annual meeting in San Antonio. They are: **Bruce K. Brown,** Pan-Am Southern Corp., New Orleans; **Harry J. Kennedy,** Continental Oil Co., Houston; **F. L. Martin,** Suntide Oil Corp., Corpus Christi; and **J. W. Vaiden,** Skelly Oil Co., Tulsa. Elected directors were **George J. Peterschmidt,** El Dorado Refining Co., El Dorado, Kans.; **W. T. Cravens,** Cities Service Oil Co., Bartlesville, Okla.; and **Henry J. Muller,** Socony Mobil Oil Co., Inc., Kansas City. All other directors were reelected.

DEATHS

John Earle Jardine, Sr., 84, Southern California investment banker and a director of Union Oil Co. of California, died March 16 in Pasadena. Jardine had been with William R. Staats & Co. 52 years, and was a partner in the firm at death.

Frank Guernsey Keefe, 61, board chairman of Caltex Trading & Transport Co., Ltd., died March 13 while vacationing in Portland, Ore. Keefe had been with The Texas Co. and affiliates since 1921.

Oliver H. Attridge, Chattanoga, chief engineer for Lucey Export Corp., New York, died recently in Bay City, Tex.

Millard P. Thomas, 61, superintendent for McLaughlin Drilling Co. in Billings, Mont., died there recently.

Clare McElhinny, 54, pipeline department superintendent in Ohio Oil Co.'s Casper, Wyo., division, died recently. He had been with Ohio 34 years.

M. C. Hagan, pioneer Michigan drilling contractor, died March 15 in his Saginaw home. He was 90. Hagan came to Michigan in 1927 and had been active there since.

George S. Rhodes, 78, retired district production superintendent of Carter Oil Co., died March 20 in Tallahassee, Fla. Rhodes joined Carter when the firm entered the Oilton, Okla., area around 1915. He retired in 1934 and had lived in Tallahassee since 1937.

W. E. Stewart, 78, East Texas independent who was active during boom days there, died March 18 in Tyler, Tex.

A. J. McNallen, 83, pioneer Breckenridge, Tex., independent, died March 19 after an auto accident there. McNallen started as a driller in the 1920 Breckenridge boom, and became a producer 2 years later.

Lester H. Keim, consultant to Byron-Jackson Co., Los Angeles, and retired vice president of Oil Well Supply Co., died March 12 in Pasadena.

Roy G. Mead, 75, Glendale, Calif., consulting petroleum engineer and geologist, died there March 15. He had been active in the southern California area 50 years.

W. Gilbert Prince, 60, owner of Prince Drilling Co., Houston, died there March 18. Prince founded his firm in 1941.

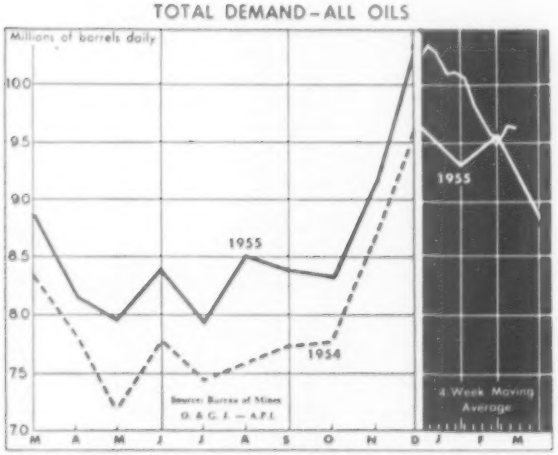
John C. Casper, Economics Editor—CURRENT STATISTICS

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,163,110	DOWN	11,350	UP	253,236
Crude stocks	255,993,000	DOWN	2,094,000	DOWN	4,551,000
Completions	1,078	UP	159	UP	36
Refinery runs	7,986,000	UP	4,000	UP	512,000
Gasoline stocks	195,941,000	UP	272,000	UP	12,101,000
Kerosine stocks	17,959,000	DOWN	310,000	DOWN	1,094,000
Distillate stocks	67,744,000	DOWN	1,995,000	UP	4,009,000
Residual stocks	35,038,000	UP	173,000	DOWN	9,763,000
Four-product stocks	316,682,000	DOWN	1,860,000	UP	5,253,000
Total imports	1,399,200	UP	159,300	DOWN	47,000

TOTAL DEMAND—ALL OILS



Group 3 Gasoline Prices Increase; Industry Shifts Operations in April

GROUP 3 gasoline prices have moved up about 0.25 cent a gallon with most of the spot regular in the pipeline selling for 11.25 cents a gallon plus pipeline charges. Premium grade still carries the same differential of 1.5 cents for a new spot low of 12.75 cents.

This increase is not in anticipation of the extra cost that will come with increased octane quality in April. It merely brings the low for regular gasoline back up to the quotation established about the time of the last crude-price increase in 1953. Near the end of June 1953 Group 3 regular was quoted at 11.375 cents a gallon. The price dropped back to 11.25 cents by the last of July and to 11.125 early in September. Further reductions in 1954 lowered the price to the level that existed before the crude-price increase. Gains late in 1954 and during 1955 lifted the low quotation to 11.00 cents.

While the price of Group 3 gasoline was climbing back to the level of the summer of 1953, gasoline quality moved up more than 3 octane numbers. This higher-quality gasoline cost the refiner about 0.5 cent a gallon more in added processing expense. Further product improvement, scheduled for April, will make it necessary for Mid-Continent refiners to raise prices again.

Pennsylvania Grade crude advanced $0.20 a barrel for most grades, effective March 16. Increased demand for crude by refiners in the area was the basis for the increase.

April is a month of changes—mostly downward . . . Some of the most important oil-industry changes come in April. Demand takes a sharp drop. Refinery runs decrease. Product stocks start to climb. Crude stocks increase. Demand for domestic crude skids. Pressure often develops for movement of surplus distillates, and light heating oil prices may soften.

For the 6-year period ended 1955, the average demand for domestic crude for April was 3.2 per cent less than during the first quarter. Last year the April demand for domestic crude was 239,000 bbl. daily under the average for the first quarter.

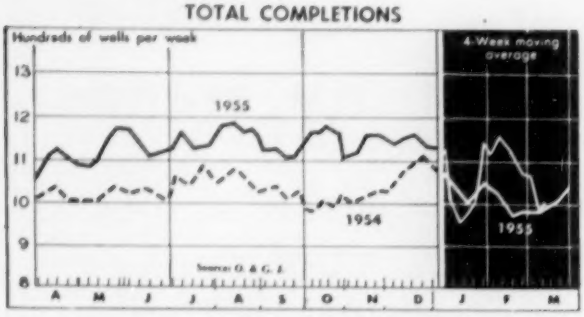
Crude production has not followed a clear-cut seasonal pattern in the past, but for the last 6 years April production has been slightly above the average for the first quarter. Announced allowables indicate a definite reduction for April compared with March this year but only a slight decrease compared with the first quarter.

For the latest 6-year period, total demand for all petroleum products dropped sharply in April. Average demand for April was 7.7. per cent less than the average for the first quarter. Last year April demand was 1,065,000 bbl. daily less than the first-quarter average.

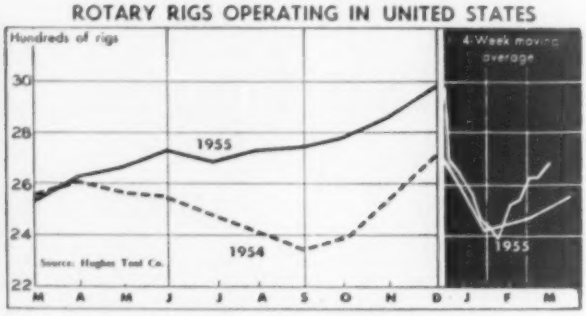
Refinery runs for April normally are about 3.3 per cent below the first-quarter average. For 1955 the drop was 294,000 bbl. daily or almost 4 per cent.

Current refinery reports indicate that runs for March may average slightly less than 8,000,000 bbl. daily. If April brings a normal reduction in refinery runs of about 250,000 bbl. daily, scheduled crude production will result in an increase of about 5,000,000 bbl. in crude stocks during the month.

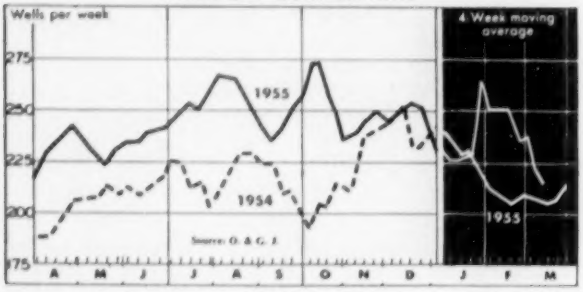
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	3-19-56	Change from 3-12-56	Change from 3-21-55
Gulf Coast	661	38	80
N. and W. Texas-New Mexico	947	15	87
Arkansas-N. Louisiana-E. Texas	157	1	—20
Oklahoma	318	7	2
Kansas-S. Nebraska	180	—3	— 7
Illinois-Eastern	99	—2	—28
Rocky Mountain	199	6	3
Pacific Coast	125	—4	—33
Total United States	2,686	58	84
Western Canada	243	—1	47

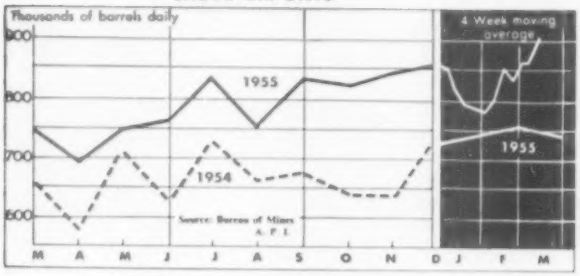
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 17, 1956

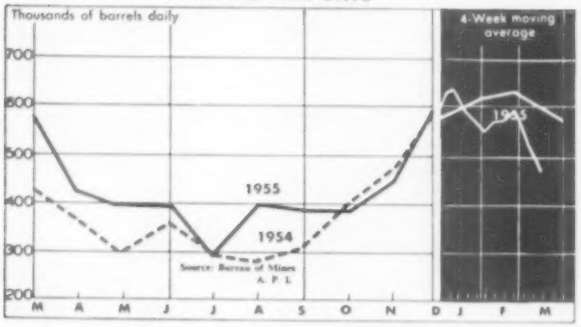
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1956	Cum. 1955	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1956: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	0	0	0	0	0	21	26	0	0	0	0	0	0	0	1	12	13
Arkansas	20	13	1	6	67,428	144	112	1	0	1	2	4	8	0	2	25	35
California	46	35	2	9	223,908	438	503	2	0	0	8	10	9	0	0	80	89
Colorado	18	3	5	10	87,417	244	268	0	0	0	8	8	4	0	3	110	117
Illinois	34	15	0	19	81,095	726	761	2	0	0	4	6	11	0	0	106	117
Indiana	6	1	0	5	7,989	117	140	0	0	0	3	3	3	0	1	28	32
Kansas	101	48	6	*47	347,365	1,026	1,048	1	0	1	16	18	21	1	7	173	202
Kentucky	31	12	5	14	40,424	363	273	0	0	0	6	6	8	0	0	88	96
Louisiana	48	29	5	14	395,945	820	791	4	1	0	7	12	25	14	5	111	155
North	18	12	0	6	73,206	304	420	1	0	0	3	4	7	0	0	37	44
South	24	12	5	7	270,441	414	371	3	1	0	3	7	17	13	3	65	98
Offshore	6	5	0	1	52,298	102	—	0	0	0	1	1	1	1	2	9	13
Michigan	10	3	0	7	23,014	108	119	0	0	0	5	5	3	0	0	35	38
Mississippi	8	0	0	8	54,212	95	94	0	0	0	6	6	4	0	1	38	43
Montana	8	6	0	2	60,180	83	83	0	0	0	2	2	5	0	0	20	25
Nebraska	16	5	0	11	82,631	191	123	0	0	0	7	7	9	0	0	89	98
New Mexico	41	23	8	10	200,685	400	262	1	0	0	5	6	8	0	5	38	51
Northwest	11	1	8	2	35,408	143	71	0	0	0	1	1	0	0	5	13	18
Southeast	30	22	0	8	165,277	257	191	1	0	0	4	5	8	0	0	25	33
North Dakota	3	3	0	0	24,889	46	42	0	0	0	0	0	2	0	0	10	12
Ohio	21	10	5	6	54,908	228	222	0	0	0	0	0	1	0	0	2	3
Oklahoma	198	129	5	†64	642,608	1,859	1,626	6	1	0	12	19	38	6	4	155	203
Pennsylvania-New York	5	0	5	0	14,001	150	354	0	0	0	0	0	0	0	1	2	3
Texas	416	289	15	112	1,882,404	4,432	3,927	15	1	2	63	81	183	12	44	968	1,207
Southwest (1 & 4)	65	36	6	23	267,433	672	627	4	1	2	12	19	39	4	16	210	269
Gulf Coast (2 & 3)	48	14	5	29	339,488	556	516	0	0	0	16	16	13	7	16	149	185
East (5 & 6)	10	6	0	4	51,340	244	222	0	0	0	2	2	1	1	3	90	95
North Central (7-B & 9)	127	81	0	46	410,475	1,485	1,378	7	0	0	24	31	83	0	1	339	423
West (7-C & 8)	139	131	0	8	724,530	1,232	972	4	0	0	7	11	43	0	6	167	216
Panhandle (10)	27	21	4	2	89,138	243	212	0	0	0	2	2	4	0	2	13	19
Utah	1	0	0	1	6,471	17	11	0	0	0	1	1	1	0	0	13	14
West Virginia	30	4	22	4	81,620	152	135	0	0	0	0	0	0	0	1	2	3
Wyoming	17	6	0	11	74,714	170	180	1	0	0	10	11	4	0	4	55	63
Miscellaneous	0	0	0	0	0	46	7	0	0	0	0	0	4	0	0	34	38
Total United States	**1,078**	634	84	360	4,453,908	11,876	11,107	33	3	4	165	**205**	351	33	79	2,194	2,657
Total previous week	919	526	55	338	3,869,462			27	2	8	159	196	318	30	75	2,029	2,452
Total March 19, 1955	1,042	607	79	356	4,117,288			24	4	9	169	206	309	36	70	1,904	2,319
Cumulative 1956	11,876	6,500	789	4,587	49,132,410												
Western Canada	57	31	2	24	293,697	475											

Service wells included: *3, †10.

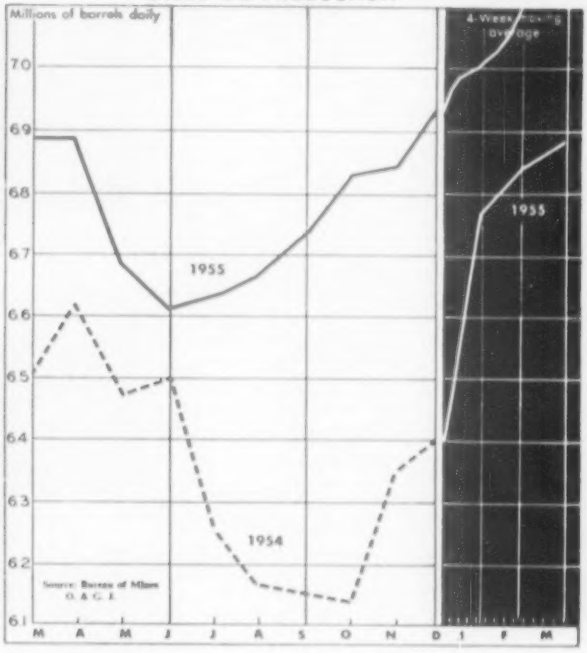
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

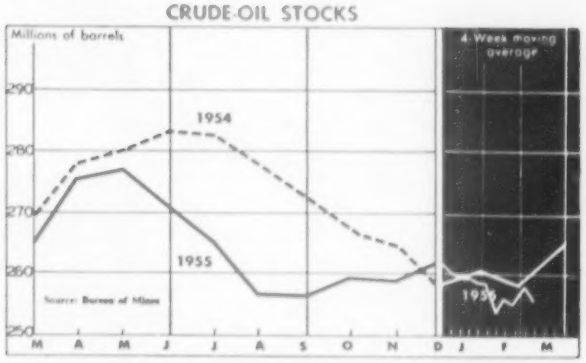


DAILY AVERAGE PRODUCTION FOR WEEK

	March 17			Mar. 10
	Crude oil	Lease condensate	Total	total
Alabama	4,200		4,200	4,200
Arkansas	73,500	500	74,000	74,700
California	968,600		968,600	970,300
Calorado	157,300		157,300	156,200
Eastern	48,700		48,700	49,600
Florida	1,400		1,400	1,400
Illinois	231,700		231,700	234,900
Indiana	31,100		31,100	31,700
Kansas	342,500		342,500	340,500
Kentucky	46,100		46,100	46,800
Louisiana	748,750	72,150	820,900	821,250
North	118,750	2,150	120,900	121,250
South	630,000	70,000	700,000	700,000
Michigan	30,000		30,000	29,800
Mississippi	106,100	4,700	110,800	110,800
Montana	51,300		51,300	50,900
Nebraska	30,900		30,900	29,900
New Mexico	242,025	3,175	245,200	245,200
North Dakota	36,200		36,200	38,300
Oklahoma	616,800		616,800	618,400
Texas	2,974,500	53,900	3,028,400	3,028,400
Dist. 1	54,000	550	54,550	54,550
Dist. 2	151,000	8,450	159,450	159,450
Dist. 3	431,000	25,300	456,300	456,300
Dist. 4	247,000	5,400	252,400	252,400
Dist. 5	47,000	500	47,500	47,500
Dist. 6	130,000	6,200	136,200	136,200
East Texas field	220,500		220,500	220,500
Dist. 7-B	163,000	50	163,050	163,050
Dist. 7-C	177,000	4,700	181,700	181,700
Dist. 8	1,050,000	1,950	1,051,950	1,051,950
Dist. 9	210,000	600	210,600	210,600
Dist. 10	94,000	200	94,200	94,200
Utah	6,100		6,100	6,250
Wyoming	280,700		280,700	284,600
Others	‡200	§10	210	360
Total U. S.	7,028,675	134,435	**7,163,110**	7,174,460
Change from previous week, down			**11,350**	
Canada	†457,150		†457,150	†397,550
Total U. S. production January 1-March 17			545,826,190 bbl.	
Same period last year (crude plus cond.)			*517,908,124 bbl.	

*Includes 8,775,050 bbl. condensate. †Week ended previous Monday. ‡Nevada. §Arizona.

CRUDE-OIL STOCKS



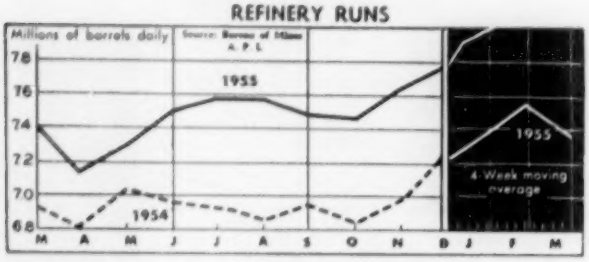
CRUDE-OIL STOCKS BY STATES OF ORIGIN

(Thousands of barrels)

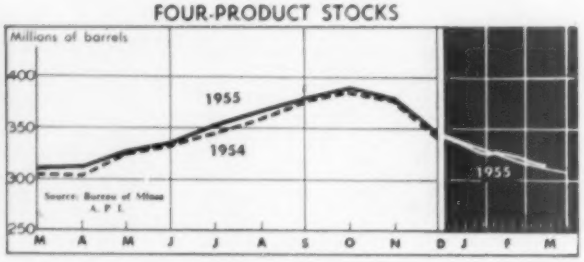
	3-10-56	3-3-56	3-12-55
Pennsylvania Grade	2,743	2,746	2,832
Other Appalachian	1,910	1,815	1,788
Illinois, Indiana, Michigan	9,412	9,476	10,902
Nebraska, North Dakota	2,179	2,066	1,599
Kansas	7,754	7,957	8,339
Oklahoma	22,421	22,638	24,508
Arkansas	2,343	2,390	3,077
Louisiana	15,753	16,038	14,534
North	2,472	2,475	2,550
South	13,281	13,563	11,984
Mississippi	3,153	3,076	3,061
New Mexico	8,202	8,286	8,160
Texas	121,987	122,281	118,729
East Texas proper	8,991	9,098	10,226
West Texas	60,411	59,800	51,273
Texas Gulf	22,293	22,289	23,565
Other Texas	30,292	31,094	33,665
Wyoming	15,691	15,106	13,951
Other Rocky Mountain	5,230	5,280	5,382
California	26,791	28,021	32,325
Foreign	10,424	10,911	11,457
Total	255,993	258,087	260,544

*Bureau of Mines. Includes 1,529,000 bbl. in California.

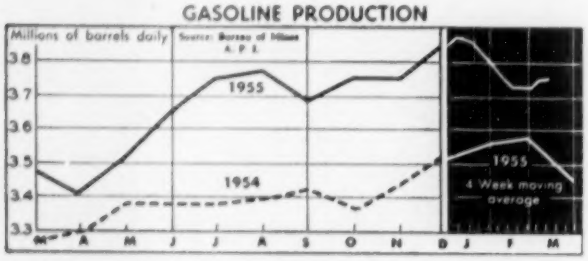
REFINERY RUNS



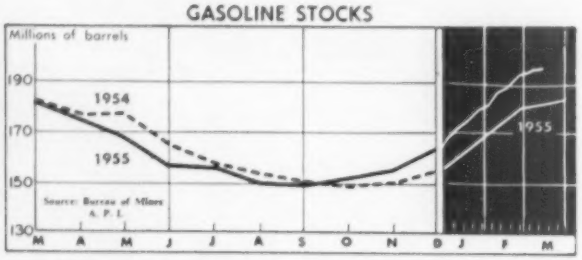
FOUR-PRODUCT STOCKS



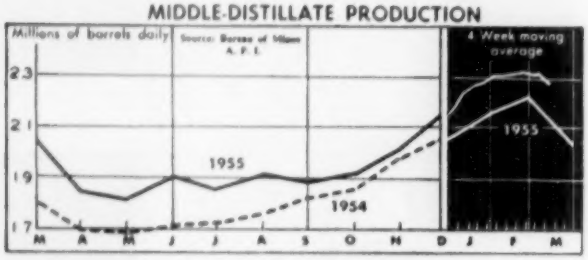
GASOLINE PRODUCTION



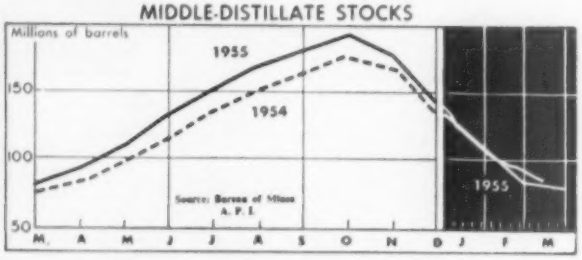
GASOLINE STOCKS



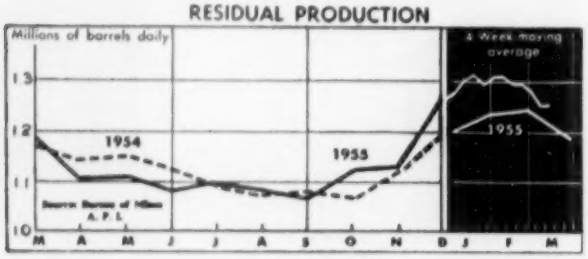
MIDDLE-DISTILLATE PRODUCTION



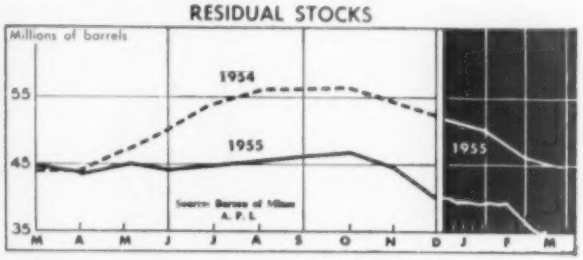
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, MARCH 16

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,164	471.7	33.4	257.1	251.3	39,049	7,943	23,511	9,614	1,102	437.2	40.4	306.4	244.5
Appalachian:														
District 1	102	33.9	5.1	20.0	6.9	4,907	469	1,395	318	98	41.2	5.2	25.2	9.1
District 2	101	44.1	6.9	18.3	16.3	3,103	337	656	257	91	47.7	6.6	19.3	15.1
Ind., Ill., Ky.	1,435	692.7	76.7	299.8	203.4	40,772	3,480	11,063	3,619	1,394	707.5	80.1	312.6	190.2
Okla., Kans., Mo.	762	429.0	30.7	190.4	34.3	22,914	764	7,127	973	670	380.0	19.0	171.5	45.4
Inland Texas	266	181.6	9.2	53.1	21.1	7,750	328	1,219	1,298	258	182.6	11.4	52.6	18.2
Texas Gulf Coast	1,969	875.2	119.0	552.3	281.7	28,504	2,410	7,682	5,567	1,894	843.4	130.6	525.8	243.5
La. Gulf Coast	727	336.7	60.0	183.9	49.4	10,334	1,208	3,956	1,783	645	305.3	60.5	165.7	39.8
N. La. and Ark.	69	24.4	5.6	16.9	3.3	4,612	480	925	70	94	33.9	10.7	21.9	6.7
Rocky Mountain:														
New Mexico	19	9.0	.....	3.0	2.1	272	6	64	28	20	11.4	0.5	3.0	2.7
Other Rocky Mtn.	279	131.3	6.6	66.6	43.9	8,358	257	2,236	830	256	119.9	4.6	62.9	40.0
California	1,093	492.7	5.4	182.9	378.0	25,366	277	7,910	10,681	1,027	456.9	4.4	180.2	383.5
Mar. 16, 1956	7,986	3,722.3	358.6	1,844.3	1,291.7	195,941	17,959	67,744	35,038	7,549	3,567.0	374.0	1,847.1	1,238.7
Mar. 9, 1956	7,982	3,804.0	370.1	1,939.0	1,195.0	195,669	18,269	69,739	34,865	.....	.....	.....	.....	.....
Mar. 18, 1955	7,474	3,491.9	400.1	1,696.0	1,219.7	183,840	19,053	63,735	44,801	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (86 octane)	11.25-11.50
★ Premium (94 octane)	12.75-13.00
Gulf Coast (Cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.25
Premium (97 octane)	13.00-13.25
New York (barges):	
Regular (89 octane)	12.25
Premium (96 octane)	14.50
California—Los Angeles (rack):	
Regular (84 octane)	12.75-13.15
Premium (93 octane)	14.10-15.10
Caribbean area (cargoes):	
Regular (87 octane)	10.50
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	5.0
Breckenridge:	
Grade 26-70	4.5

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.25-10.375
Diesel oil (58 d.i. and above)	9.875-10.00
Distillate No. 1	9.875-10.00
Distillate No. 2	9.25-9.375
Gulf Coast (cargoes):	
Kerosine 41-43	9.5-9.625
Distillate No. 2	9.00-9.25
New York Harbor (barges):	
Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65
Caribbean area (cargoes):	
Distillate No. 2	9.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.10

★ Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$2.10-2.15
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.10-2.20

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	23.5
200 vis. neutral (180 at 100°), 25 p.t.	20

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16.16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$2.91	2.45	
25-25.9	2.64	2.60	2.93	2.47	
26-26.9	2.69	2.62	2.95	2.49	
27-27.9	2.76	2.64	2.97	2.51	
28-28.9	2.83	2.66	2.99	2.53	
29-29.9	2.91	2.68	3.01	2.55	
30-30.9	2.97	2.70	3.03	2.57	
31-31.9	3.04	2.72	3.05	2.59	$2.46
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.50
34-34.9	3.27	2.78	3.11	2.65	2.52
35-35.9	3.34	2.80	3.13	2.67	2.54
36-36.9	3.39	2.82	3.15	2.69	2.56
37-37.9		2.84	3.17	2.71	2.58
38-38.9		2.86	3.19	2.73	2.60
39-39.9		2.88	3.21	2.75	2.62
40 and up		2.90	3.23	2.77	2.64

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas, and Wyoming (sweet). †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, March 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
★ Bradford	4.20
★ Middle District	4.07
★ Southwest Pennsylvania	3.78
★ West Virginia	3.66
★ Buckeye Grade	3.60
★ Zanesville Grade	3.02
Illinois Basin	3.00
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-48.9°, Tucupido	*$3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	†2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES (PER LONG TON)

(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC—10%)	$2.56
NWI-U.S.N.H., dirty (USMC—10%)	2.43
★NWI-U.K., dirty (Scale 20%) (39s. 0d.)	5.50
★Persian Gulf-U.S.N.H., dirty (USMC—17.5%)	10.48
★Persian Gulf-U.K., dirty (USMC—7.5%)	10.08
★Persian Gulf-France, dirty (USMC—12.5%)	9.36

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4'x59' 160 PSI 23 trays.
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Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

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Very good No. 1 grade, used pipe. Straight 20' single random lengths machine cleaned.

Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi. Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ½ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

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WANTED—Mathey or similar unit for flowing well paraffin scraping complete or unit only. Mumy Well Service, Reed City, Michigan.

HELP WANTED

MALE TECHNICAL graduate wanted for gasoline testing laboratory in Tulsa, Oklahoma. Forty-hour week with excellent working conditions and liberal employee benefit plans. State experience and salary expectation. Box J-445, The Oil and Gas Journal, Tulsa, Oklahoma.

POSITION OPEN IMMEDIATELY. Experienced land man under 40 years to buy pipeline right-of-way and settle damages in Oklahoma, Kansas, Texas, and Missouri. Salary and expense account. Contact Cities Service Gas Company, Box 1995, Oklahoma City, Oklahoma, or call RE 6-0601, Ext. 247.

HELP WANTED

GAS ACCOUNTANT with several years experience in general and gas accounting and some experience in supervising personnel—about 35 years age. Box J-391, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—URANIUM GEOLOGIST with background of exploration and evaluation experience by major oil company. Send complete resume of education, experience, and salary requirement to Box J-447, The Oil and Gas Journal, Tulsa, Oklahoma.

EMULSION PLANT SUPERVISOR. Venturing into asphalt emulsions and have opening for man thoroughly experienced in this field. Preferably under 35 years of age. Location Tuscaloosa, Alabama. Submit complete resume of background and experience. Hunt Oil Company, P. O. Box 3053, Dallas, Texas.

EXPERIENCED Petroleum Engineers to fill vacancies created by expansion wanted by medium sized oil company operating in all areas east of California. Applicants should have minimum of 3 years field experience. Replies confidential. Please furnish detailed summary of academic and experience background. Box J-377, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICAL POSITIONS AVAILABLE

WANTED, Party Chiefs, Seismologists, Computers, Surveyors, and Observers for domestic work in Louisiana, Texas, Oklahoma and New Mexico, and possibly some foreign work.

REQUIREMENTS: Interpretive positions must have a minimum of two (2) years college plus experience. Field positions must have minimum two (2) years experience. Observers with SIE, Electro-Tech and Century experience preferred. Mail letter of inquiry with pertinent information and references to:

SOUTHERN GEOPHYSICAL COMPANY

P. O. Box 12317, Fort Worth, Texas
Route 4, Box 646, Houston, Texas

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

GEOLOGIST—Growing active fully integrated Oil Company needs a young Geologist with two or three years sub-surface experience in South Louisiana. Apply by letter giving qualifications and salary. Box J-451, The Oil and Gas Journal, Tulsa, Oklahoma.

MARKETING

High type chemist or chemical engineer with petroleum refinery experience for marketing position which can lead to sales management for the right person. Send resume and salary expected to

BOX J-454,

THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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For drilling production and equipment on varied types active fields.

EXCELLENT SALARY, ALLOWANCES, OPPORTUNITY OBTAIN ADDITIONAL EXPERIENCE & ADVANCEMENT.

Positions Available Venezuela & Colombia. Graduate Engineers—minimum 2 years exp.

Forward Personal data, college transcript, to:

C. L. LAUE

SOCONY MOBIL
OIL CO., INC.

26 Broadway, New York 4, New York

HELP WANTED

PETROLEUM ENGINEER—Gas transmission company in Rocky Mountain area needs Petroleum Engineer in reserves section. B.S. or M.S. degree. Two years experience in general engineering or reservoir engineering. Salary commensurate with experience and training. Permanent employment with liberal employee benefits. Submit details of qualifications and experience to Box J-437, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE SURVEYOR

. . . for gas-gathering system extensions, Tioga-Beaver Lodge area, Tioga, North Dakota. Must have instruments and transportation. State experience, rate, and availability.

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P. O. Box 457, Tioga, N. D.

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Experienced Toolpushers and Drillers

Well established Drilling Contractor planning large expansion in offshore operations cannot fill all anticipated vacancies from organization.

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Send letter giving qualifications, experience and references to:

Box J-425, The Oil and Gas Journal, Tulsa, Oklahoma.

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Piping Layout, Structural Steel, Concrete, Process Heaters, Equipment Specifications, Layout and Process Design. Also Piping and Electrical Draftsmen.

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By substantial independent oil company to locate in Western Kentucky to initiate and be responsible for all phases of a development program for oil production in this new shallow oil producing area.

Will require living in nearest best suited town. Supervising any necessary help to analyze the play. Working out deals and buying leases to drill. Supervising such drilling and any resulting production. All under general supervision of company's main, Tulsa headquarters.

A salaried position with a reward success.
Please give full information in First Letter. Refer to

BOX J-452,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

ENGINEER

PETROLEUM REFINERY PROCESSING PLANT EXPERIENCE

Leading firm specializing in engineering and construction of petroleum refining and chemical plants, with main offices in New York City, requires graduate engineer experienced in commissioning petroleum refinery processing plants. Must be capable of assuming engineering duties in engineering offices between field assignments.

Replies should give complete personal data, education, experience and salary requirements.

Box J-449, The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

GEOLOGISTS—Two to four years experience for work in Gulf Coast Area. Salary commensurate with experience. Replies confidential. Lion Oil Company, a Division of Monsanto Chemical Company, P. O. Box 1607, Shreveport, Louisiana.

ENGINEER—Gas transmission company in Rocky Mountain area needs Junior Engineer for pipeline and meter station design, material specification and expediting. Work in Engineering Department with experienced Engineers on above problems as well as sizing pipelines, gathering system studies, pipeline efficiencies and revision of existing pipelines. Starting salary $425.00. Permanent employment with liberal employee benefits. Submit details of qualifications and experience to Box J-436, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL FIELD SERVICE ENGINEERS

Mechanical or Petroleum Engineers with some field experience. Men without degrees but with two years rotary or workover rig experience may qualify. High school diploma or equivalent required. Age under 35 preferred. Good pay with excellent fringe benefits. Automobile and expenses.

Contact

BAKER OIL TOOLS, INC.

P. O. Box 3048

HOUSTON 1, TEXAS

HELP WANTED

SALES ENGINEER (New Product)

Graduate petroleum, mechanical or chemical engineer with petroleum experience needed for interesting assignment to assist in development and promotion of new equipment for use in petro-chemical industry. Should be familiar with oil processing equipment, design and application. Work will include personal contact with major oil companies. Sales experience helpful.

Mail brief description of qualifications to:

DORR-OLIVER INCORPORATED
2900 Glascock St.
Oakland 1, California.

ENGINEERS

Major Oil Company has openings in drilling, production & pipe line departments in Venezuela for graduate petroleum, mechanical & civil engineers. Salary commensurate with experience. Please send details of experience to:

P. O. Box #35
Bowling Green Station
New York 4, New York

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EXPERIENCED NATURAL GAS engineers or petroleum engineers with natural gas experience needed by oil company with expanding gas operations. Minimum of 4 years necessary. Applicants should submit resume of education, experience and state salary expected. All applications treated confidentially. Box J-385, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE DRAFTSMAN

for converting surveyors notes to finished pipeline plan and profile drawings. State experience, rate, and availability.

SIGNAL OIL AND GAS CO.,
P. O. Box 457, Tioga, N. D.

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Active independent oil company has vacancies for graduate petroleum engineers with two to five years of practical experience in drilling and production in West, West Central or North Texas. Excellent opportunities for growth and advancement. Replies should furnish complete personal data, education, experience, and starting salary desired.

BOX J-300,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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Aggressive young man for challenging and very attractive opportunity with growing 75-year-old manufacturer of pipeline products. In addition, he should have the following qualifications:

Age: 28 to 35

Education: College degree in engineering and/or comparable experience working closely with the operations end of the pipeline industry.

This man will make his own bright future by managing and developing products and sales in a proved but largely unexploited market. He will enjoy the backing of strong, alert management. Quite a bit of travel is involved, naturally.

Write in strictest confidence to

Box J-450,
The Oil and Gas Journal,
Tulsa, Oklahoma.

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Affiliates of

STANDARD OIL COMPANY (New Jersey)

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SOUTH AMERICA

Have staff positions now open for:

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Will plan, schedule and coordinate oil refinery maintenance and construction projects and/or provide technical assistance to refinery crafts.

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Assignments may include project development, cost estimation, materials specifications, design and drafting, and construction follow-up.

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Giving complete address, age, marital status, education and details of previous experience. Box 308-L, Radio City Station, New York 19, N. Y.

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For reservoir studies, reserve estimation & development work on varied types active fields.

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Forward personal data, college transcripts, to:

C. L. LAUE

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OIL CO., INC.

26 Broadway, New York 4, New York

SITUATIONS WANTED

OIL OPERATORS—Low temperature separation (glycol injection) and dehydration man with production and well completion experience. Married, 33, employed. Desire to make change. Box J-444, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER: 35, eleven years drilling and production engineering, (including reserve estimates) in Gulf Coast. Excellent references. Box J-438, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—15 years field and 5 years executive domestic and foreign experience. Good organizer. Desires position with permanent base but no objections to traveling. Degree. Box J-442, The Oil and Gas Journal, Tulsa, Oklahoma.

SUBSURFACE GEOLOGIST—B.S., married, 4 years with major, West Texas-New Mexico. Specialize in subsurface mapping and lease evaluation. Desire responsible position with small well-integrated oil company. Box J-433, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPE LINE ENGINEER: Graduate Petroleum Engineer, 36, with family, with 10 years diversified experience in design, construction and operation of crude & gas pipelines and pump stations with major company. Presently employed in South America. Desire position in United States. Write Box J-453, The Oil and Gas Journal, Tulsa, Oklahoma.

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HIGHEST PRICES PAID for choice oil and gas income royalties, overrides, oil properties. A. S. Berry, P. O. Box 1383, Tulsa, Oklahoma.

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5 TO 500 WELLS WANTED. Serious buyer seeks willing sellers with expert reports. Quick action. Strictest confidence. Box J-423, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED

TO PURCHASE oil production or corporations having production for cash or stock in a listed company (or combination of both). All replies strictly confidential. Box J-412, The Oil and Gas Journal, Tulsa, Oklahoma.

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Box J-435, The Oil and Gas Journal, Tulsa, Oklahoma.

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Wants to acquire

Oil Companies with Production

for Exchange of Stock.

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The Oil and Gas Journal,

Tulsa, Oklahoma.

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Every wildcat has been checked in the basin and posted todate. All fields outlined and named. Contours are 500 ft.

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San Bernardino

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MAILING LISTS

Royalty Investors. Other oil lists. Oil Industry Mailing List Co., 405 Tuloma Bldg., Tulsa, Okla.

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FOR LEASE: Warehouse under construction on T&P trackage. Fireproof. Office available. Write Box 1127 or telephone 3-3980, Midland, Texas.

REAL ESTATE AUCTION
March 30, 1:00 P. M.

To close Estate of Paul M. Thompson. 2,500 acre Elk County, Kansas Ranch. On the ranch, 6 miles E. & 6 miles N. of Howard, Kans. Excellent Blue Stem Grass. 12 Deep Ponds. 2 Houses, corrals, chutes, scale, barns and machine shed. Automatic Water system for house and corrals. Two Cement Silos. All mineral rights sell with land. For information call McAnarney Auction Co., Pratt, Kans. Phone 666.

LEASE AND DRILLING BLOCKS

CONTACT A. L. Bowles, Box 947, Ada, Okla., for Drilling Deals, Oil Production.

FEDERAL LAND LEASE available for drilling now. Weston Co., Wyo.; Carbon, Grand, Uintah Cos., Utah. D. M. Cooper, 35 East Woodbury, Altadena, Calif.

FOR SALE: Three year option on 33,000 acre block in T 11 & 12 S, R 94 W, Delta Co., Colo. $2.50 & 2½% ORR. Good gas possibilities. Box J-370, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL, GAS & URANIUM lease, 78,400 acres New Mexico. Solid tract, one owner. $1.00 per acre bonus, 50c per acre annual rentals 10 year commercial lease. Box J-418, The Oil and Gas Journal, Tulsa, Oklahoma.

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Producing and Nonproducing
Bought and Sold—Any Area

Inquiries Invited

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OF CHOICE OKLAHOMA LEASES

We are selling approximately 4,000 acres of leases in Creek, Payne, Noble, Lincoln and other counties. These leases acquired over past four years are all geologically sound. Have seismic and subsurface on many leases that will be made available to purchaser. Will sell on sealed bid basis. Bids acceptable on 1 lease or all. Bids to be opened April 9, 1956. For description of leases and full details of sale write

Box J-424, The Oil and Gas Journal, Tulsa, Oklahoma.

LEGAL

SEALED BIDS will be received until 2:00 P. M., Mountain Standard Time, April 4, 1956, and opened at that time in the Office of the Fort Peck Indian Agency, Poplar, Montana, for the leasing of 2,379.92 acres of Tribal land and 12,525.91 acres of allotted Indian land, located in Roosevelt and Daniels Counties, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Fort Peck Indian Agency at Poplar, Montana, or telephone, Poplar, 2181.

Equipment Men

Donnelly To Represent Pritchard in Washington

F. K. DONNELLY

The Frank K. Donnelly Co. of Seattle has been appointed sales representative in the State of Washington by J. F. Pritchard & Co. of California, Kansas City, Mo.

Donnelly has been a manufacturer's representative since 1954 and now specializes in industrial equipment for the Pacific Northwest. From 1952 to 1954 he was a sales engineer for Trane Co. in the Seattle area.

Two Sales Representatives Named by Wolverine Tube

Bob L. Roberts and Ralph E. Seaton have been appointed technical sales representatives, it has been announced by F. F. Moore, eastern district assistant sales manager for Wolverine Tube, division of Calumet & Hecla, Inc. Roberts' territory will cover Philadelphia and the surrounding areas. Seaton will contact industry in New York, New England, and northern New Jersey.

Roberts, who will headquarter in Wolverine's Philadelphia office, was formerly technical office sales representative in Wolverine's general sales office, Detroit, Mich. Seaton will establish headquarters in Wolverine's New York office.

Oil Base Appoints Foreign and Domestic Distributors

Oil Base, Inc. of Compton, Calif., has announced the appointment of the following domestic distributors of their No-Glo oil and No-Glo nonfluorescent thread lubricant: Lamb Transportation Co., Long Beach, Calif., serving all of California; Terminal Petroleum Co., Harvey, La., serving the New Orleans area; Southwest Texas Oil Sales, Sinton, Tex., serving South and Southwest Texas; and M & H Distributors, McAllen, Tex., serving the Rio Grande Valley.

The following foreign distributors of Black Magic drilling muds and other OBI products, as sales and service representatives, have been appointed: Baritina de Venezuela, S.A., Caracas, Venezuela, will serve the entire Venezulean area, with George Crocker and John Simons, servicing engineers, available. A. Z. Export, S.A., Bogota, Colombia, will serve all of Colombia with M. R. Vollmer as representative.

In western Canada, Pacific Western Mud Service, Ltd., Calgary, Alta., will serve the provinces from stocks in Red Deer. Clint Buffington, representative, is in charge.

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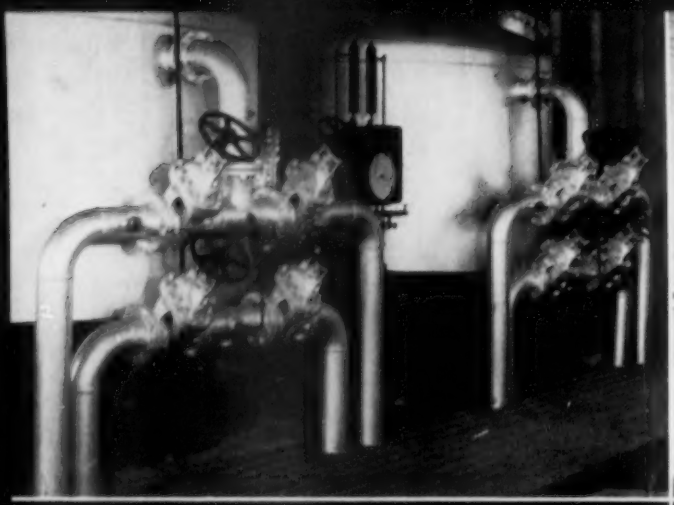

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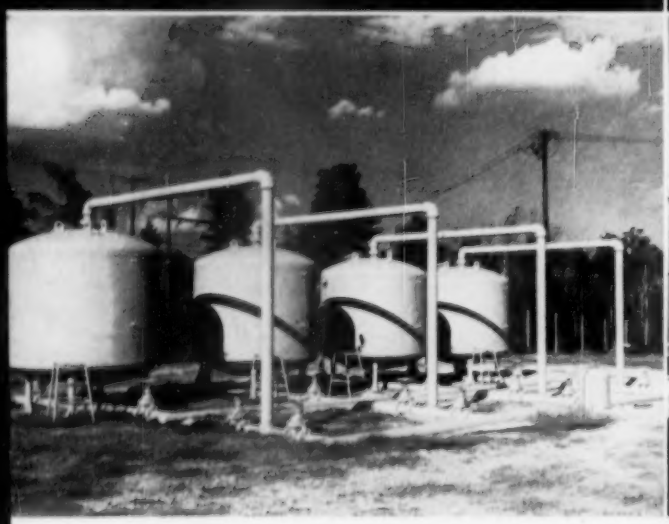
Battery of 200 PSI W.P. National Filters in West Texas Water Flood



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For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma, Dept. C-11.

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You may be assured that with STRAIGHT GRIP tool joints on your drill pipe, your string will "hang together" under the most severe drilling conditions.

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MANUFACTURERS OF OIL FIELD EQUIPMENT
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OKLAHOMA CITY

AMERICAN IRON
Straight Grip
TOOL JOINTS

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